2013 Monsoon (with context)

Environmental Quality Advisory Council
September 18, 2013

Zack Guido
Climate Assessment for the Southwest (CLIMAS)

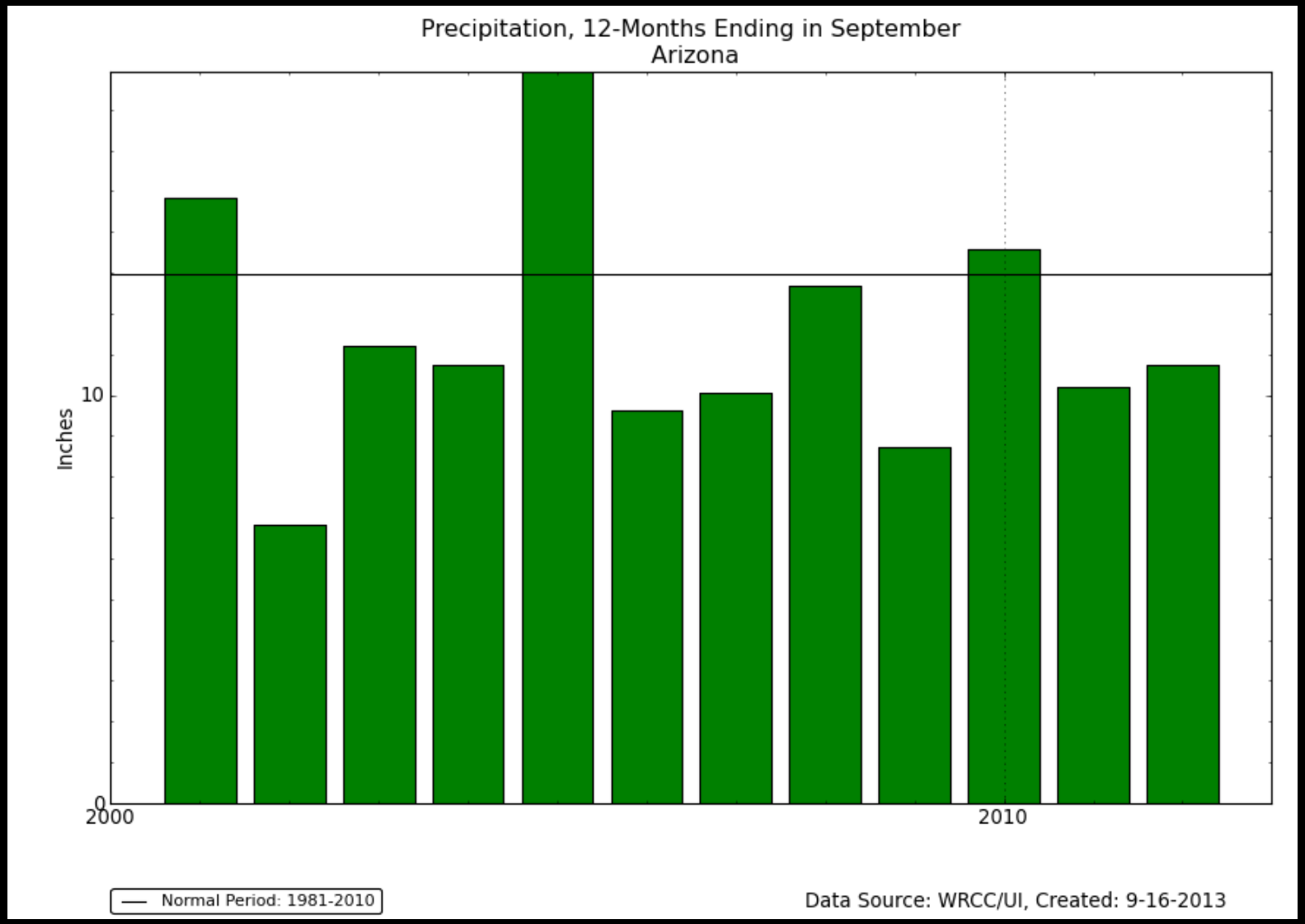
It’s been very spotty

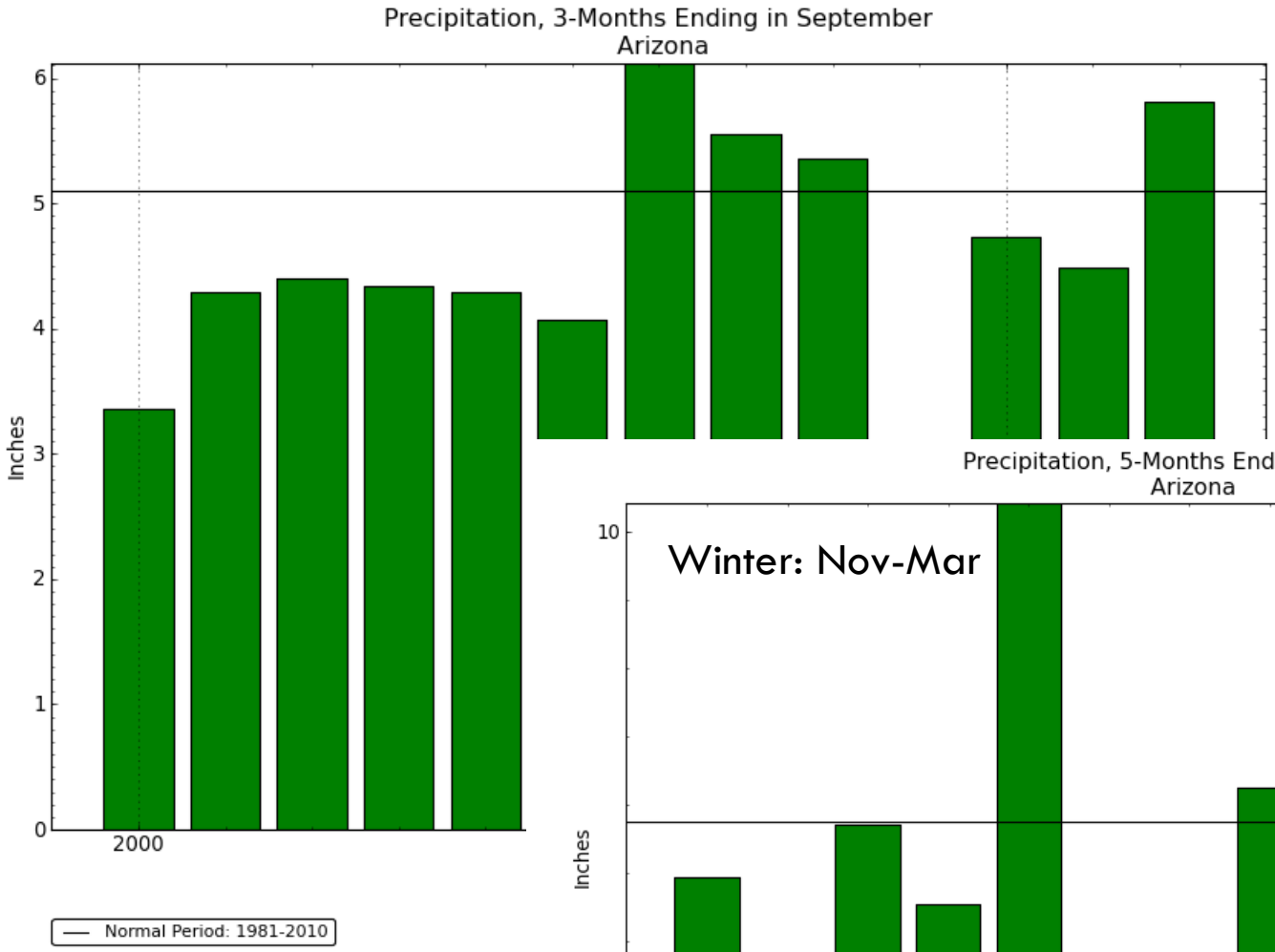
Seems like it’s the driest
we’ve had in a long time

It’s the greenest I’ve seen

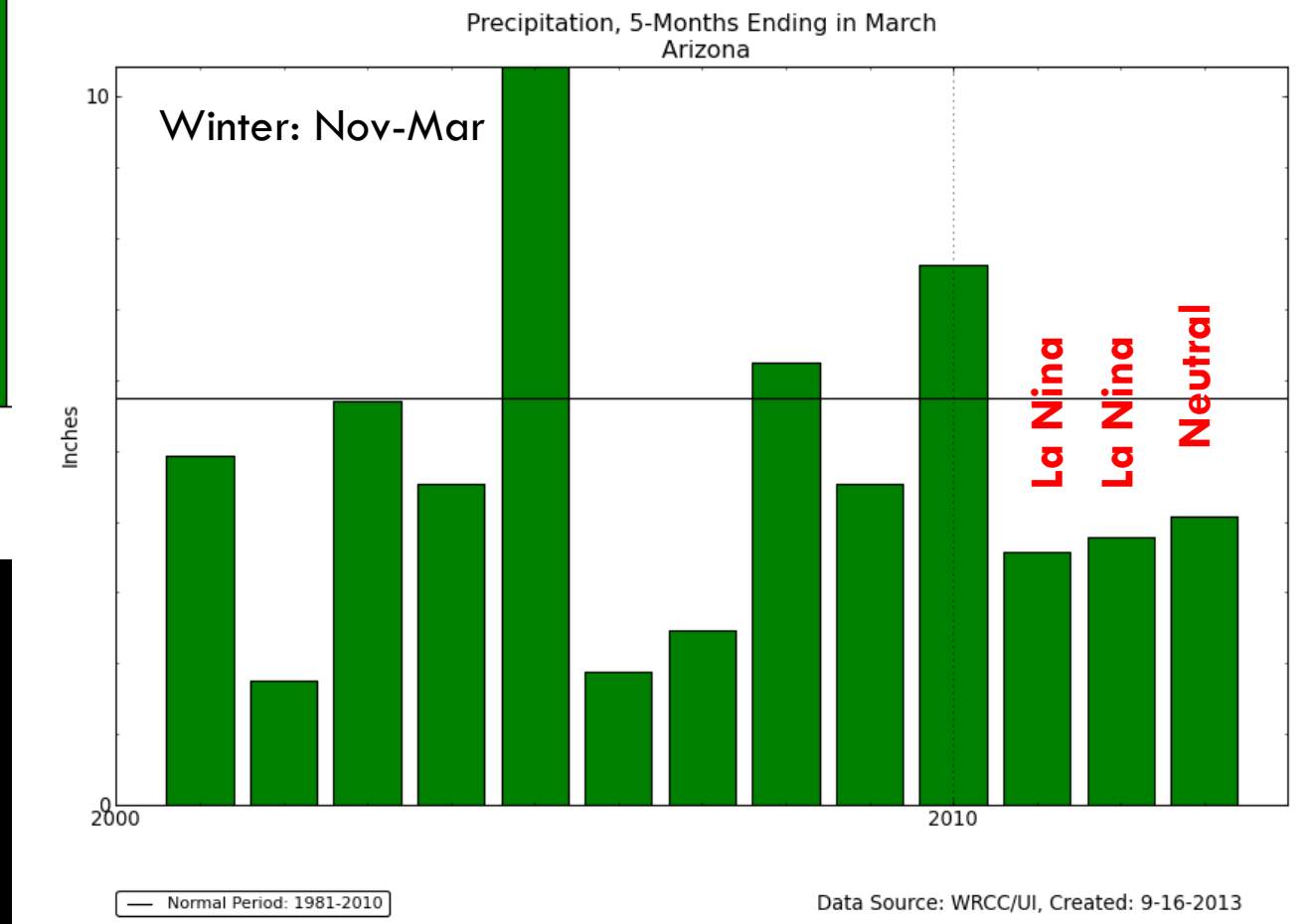
It was the best of times, it was
the worst of times

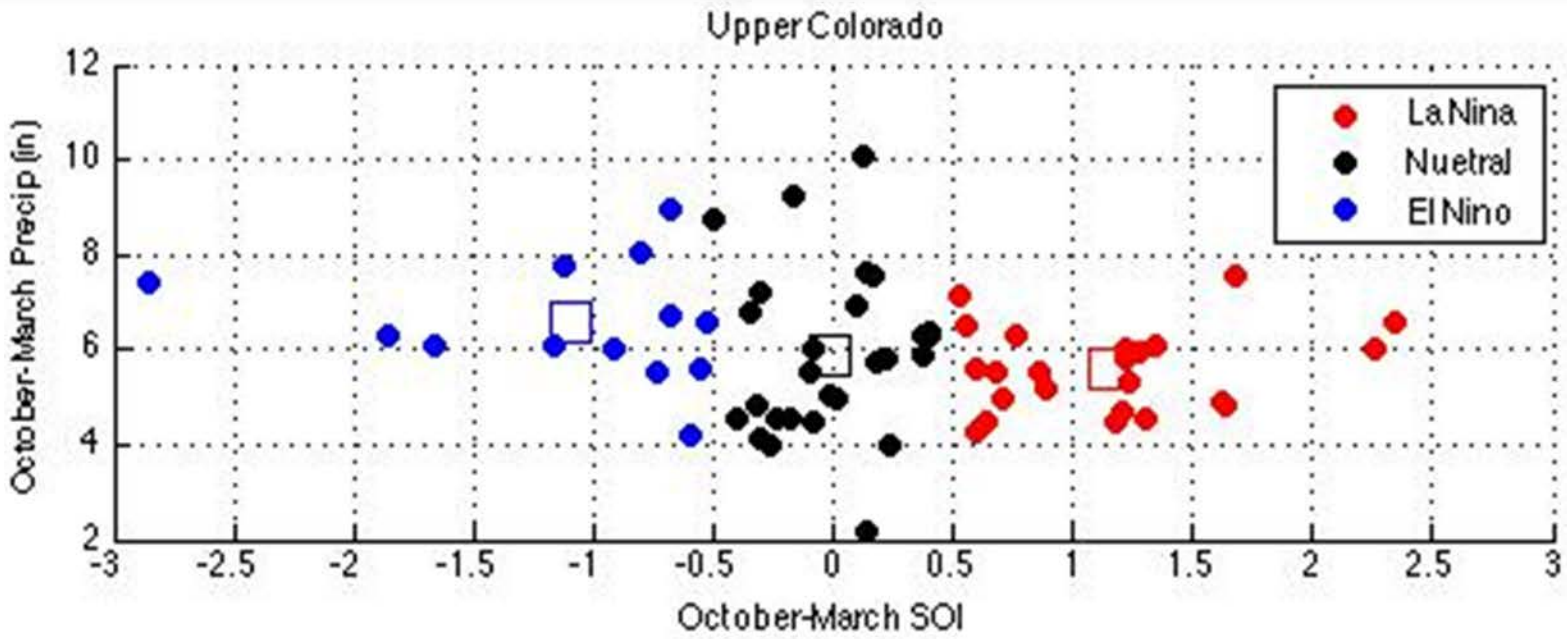
The climate context

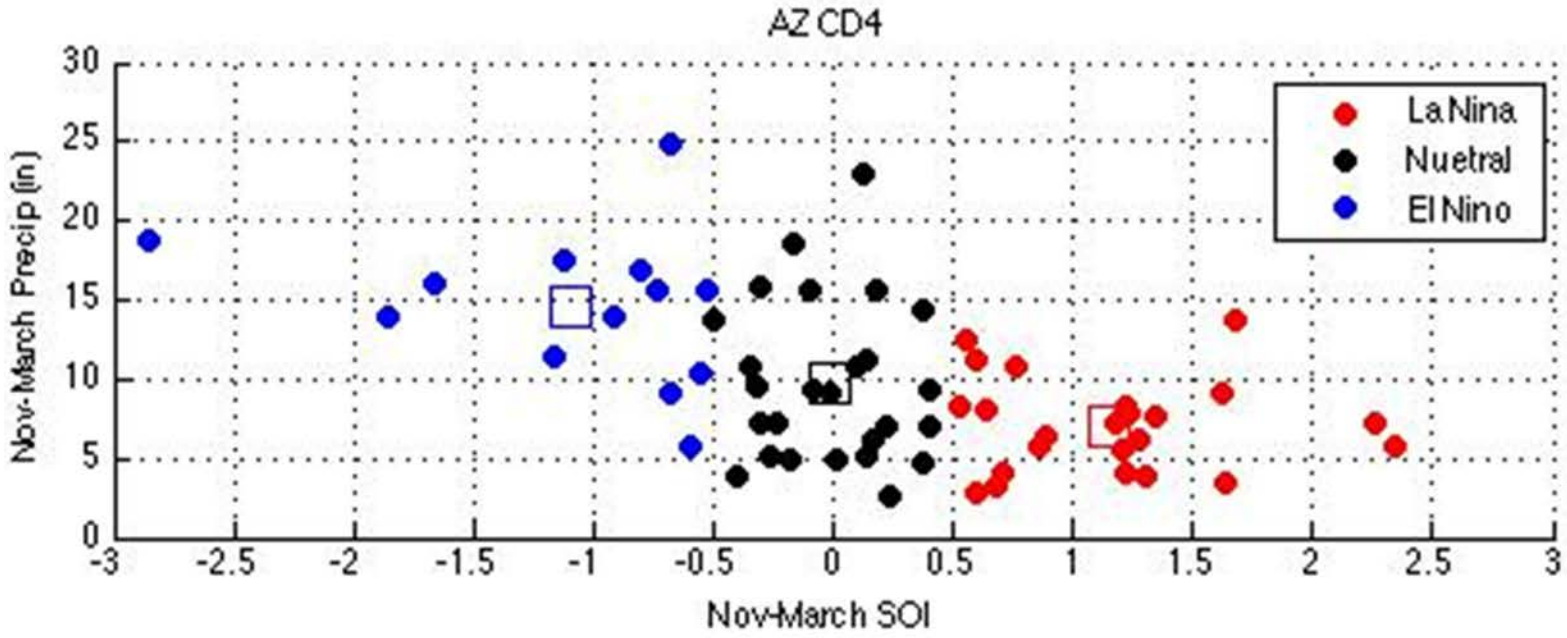


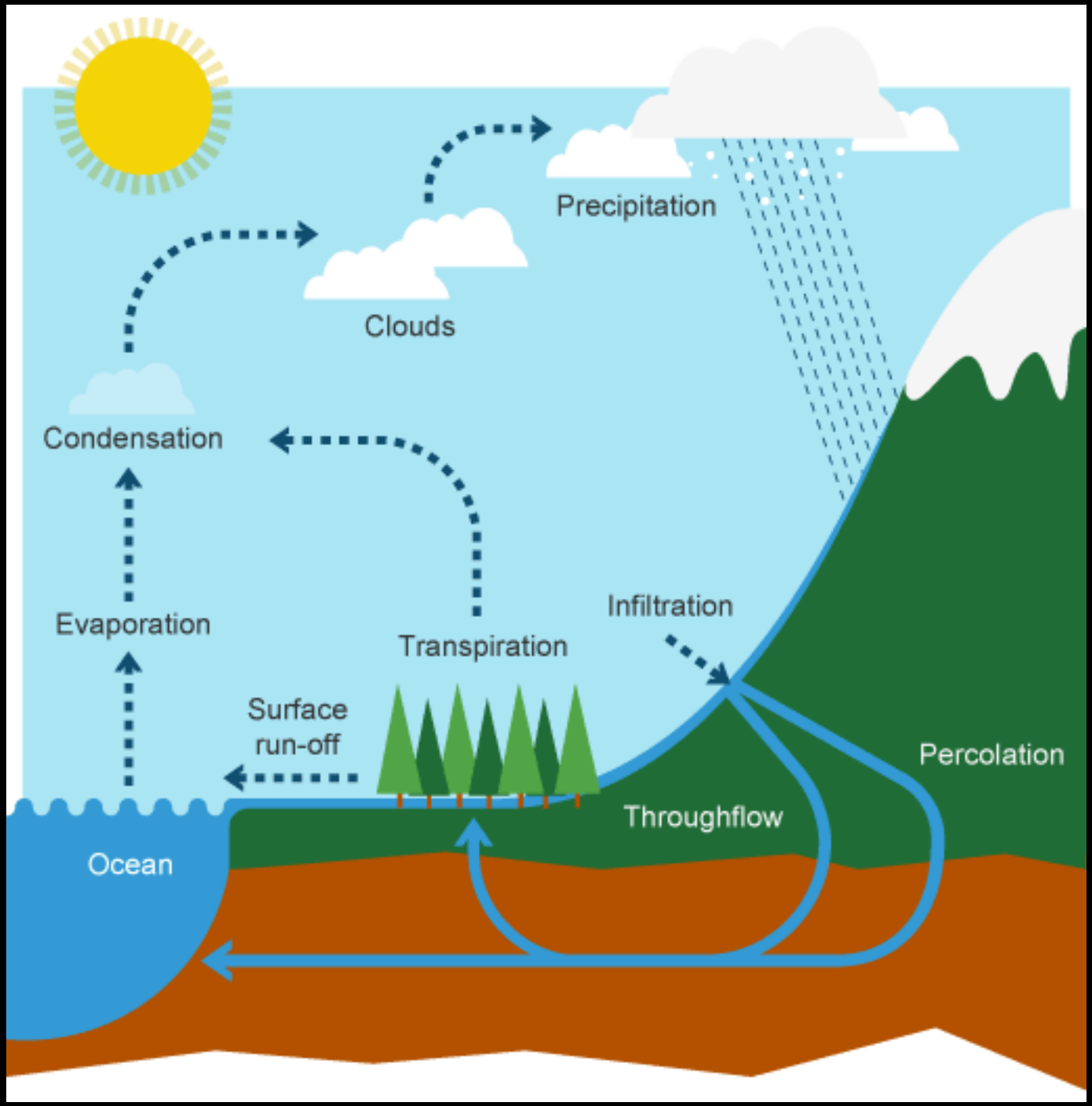

Precipitation, 3-Months Ending in September
Arizona
Inches
0
1
2
3
4
5
6
2000
Normal Period: 1981-2010

Monsoon: JAS

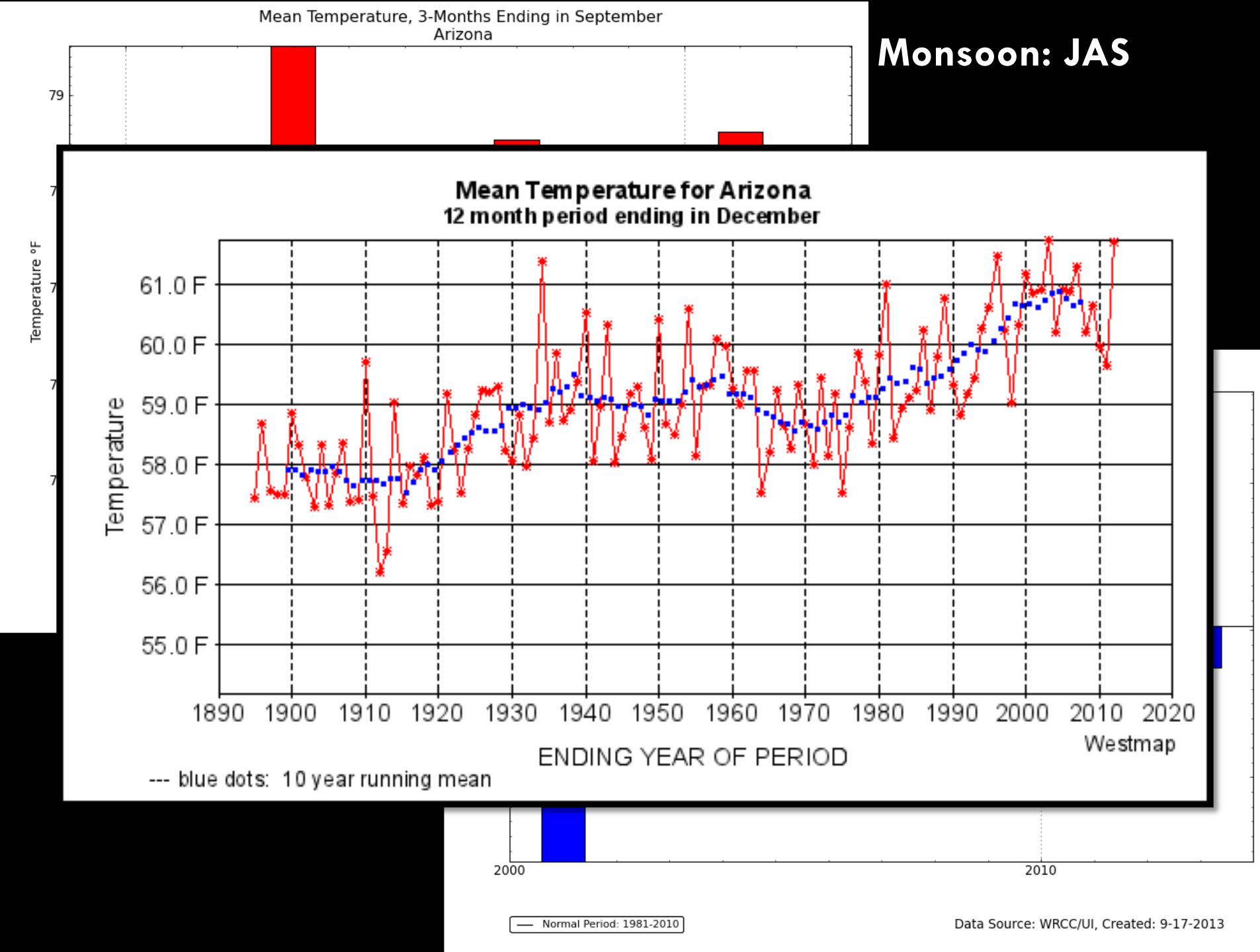

Precipitation, 5-Months Ending in March
Arizona
Winter: Nov-Mar
Inches
0
10
2000
2010
La Nina
La Nina
Neutral
Normal Period: 1981-2010
Data Source: WRCC/UI, Created: 9-16-2013

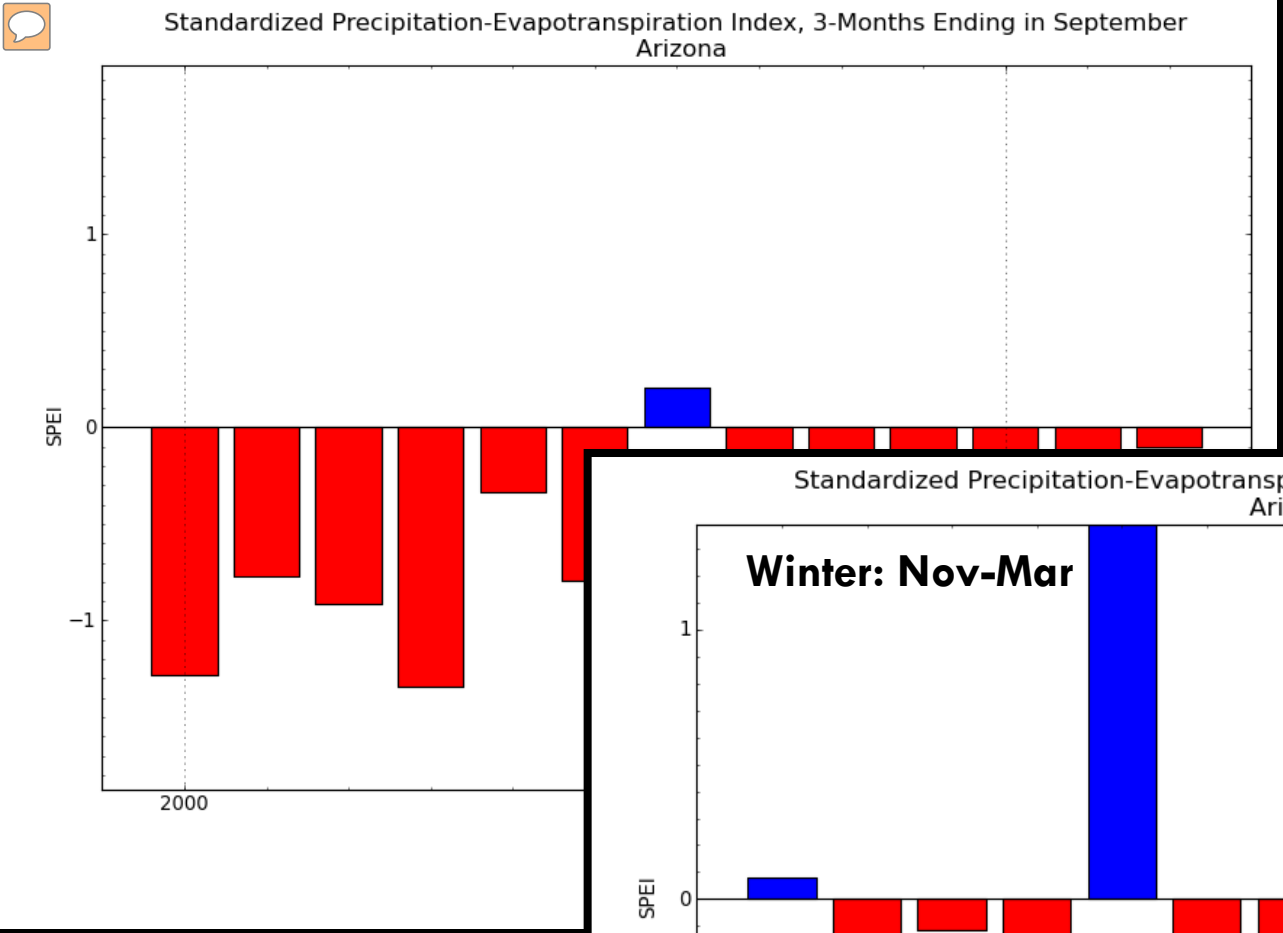

Upper Colorado
October-March Precip (in)
October-March SOI
La Nina
Nuetral
El Nino
12
10
8
6
4
2
-3
-2.5
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
2.5
3


AZ CD4
Nov-March Precip (in)
Nov-March SOI
La Nina
Nuetral
El Nino
30
25
20
15
10
5
0
-3
-2.5
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
2.5
3

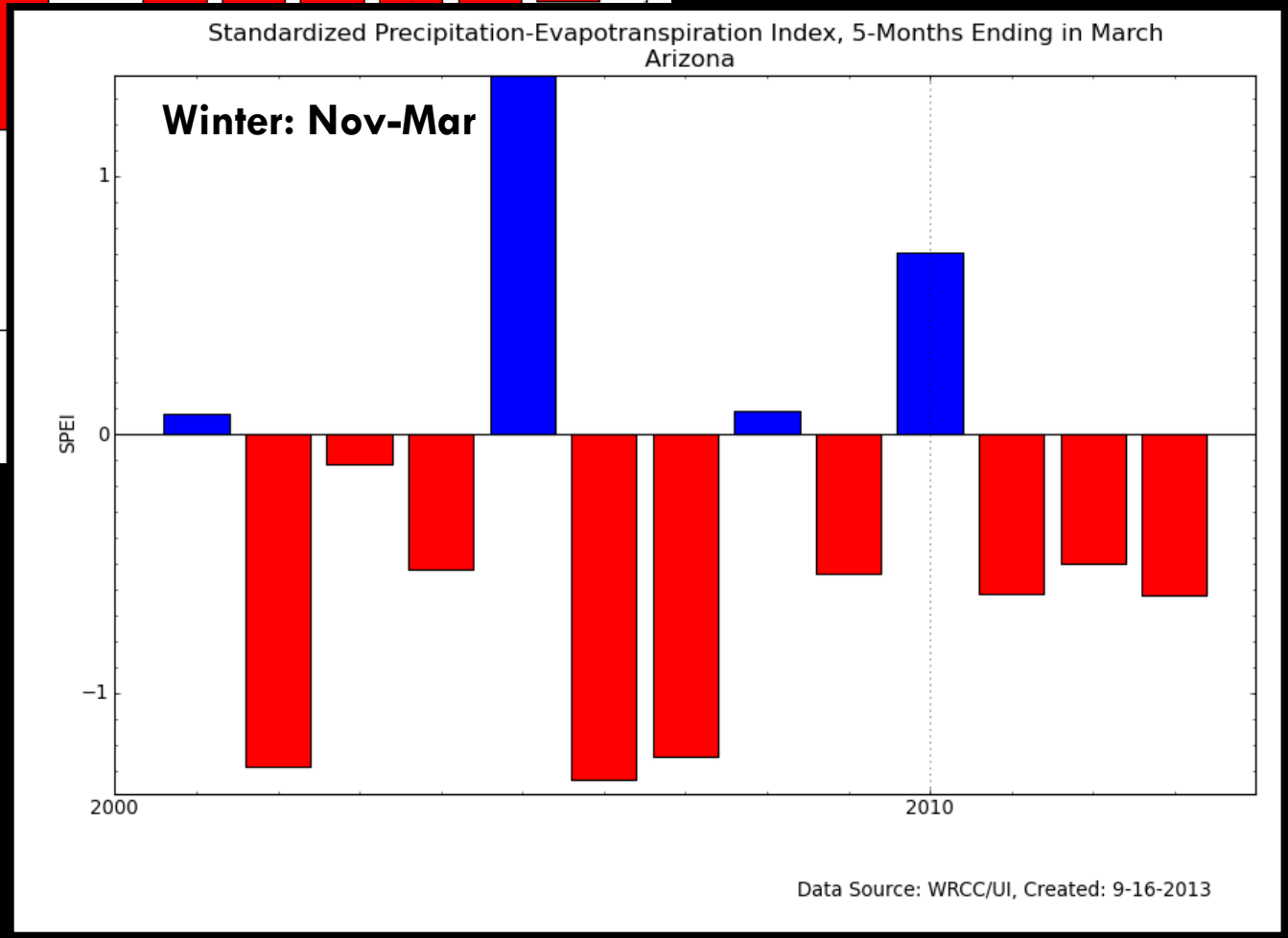

Precipitation
Clouds
Condensation
Evaporation
Transpiration
Infiltration
Surface
run-off
Percolation
Throughflow
Ocean

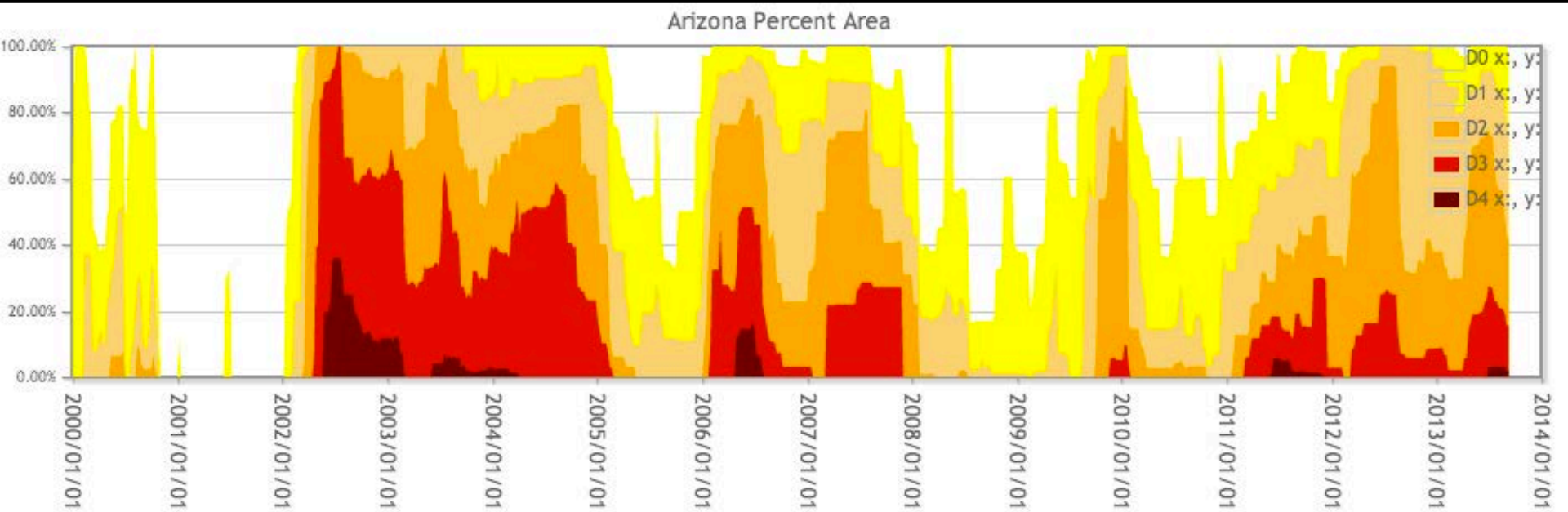
Monsoon: JAS

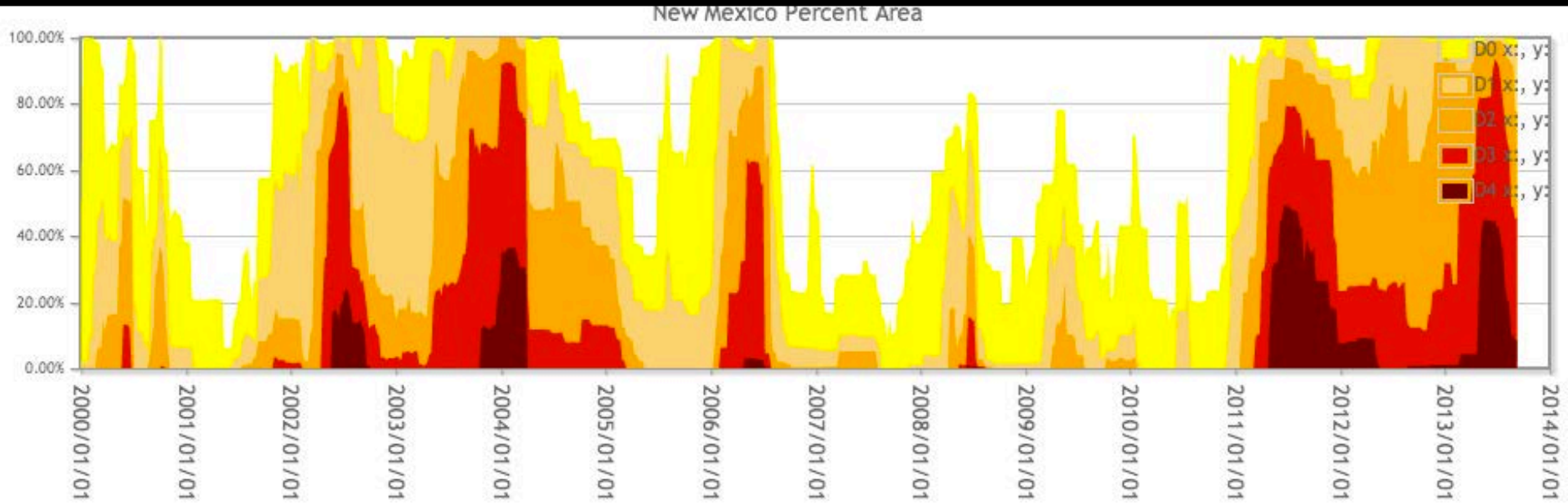

Mean Temperature, 3-Months Ending in September
Arizona
Temperature °F
79
2000
2010
Normal Period: 1981-2010
Data Source: WRCC/UI, Created: 9-17-2013
Mean Temperature for Arizona
12 month period ending in December
Temperature
61.0 F
60.0 F
59.0 F
58.0 F
57.0 F
56.0 F
55.0 F
1890 1900 1910 1920 1930 1940 1950 1960 1970 1980 1990 2000 2010 2020
ENDING YEAR OF PERIOD
Westmap
--- blue dots: 10 year running mean


Standardized Precipitation-Evapotranspiration Index, 3-Months Ending in September
Arizona
SPEI
1
0
−1
2000

Monsoon: JAS

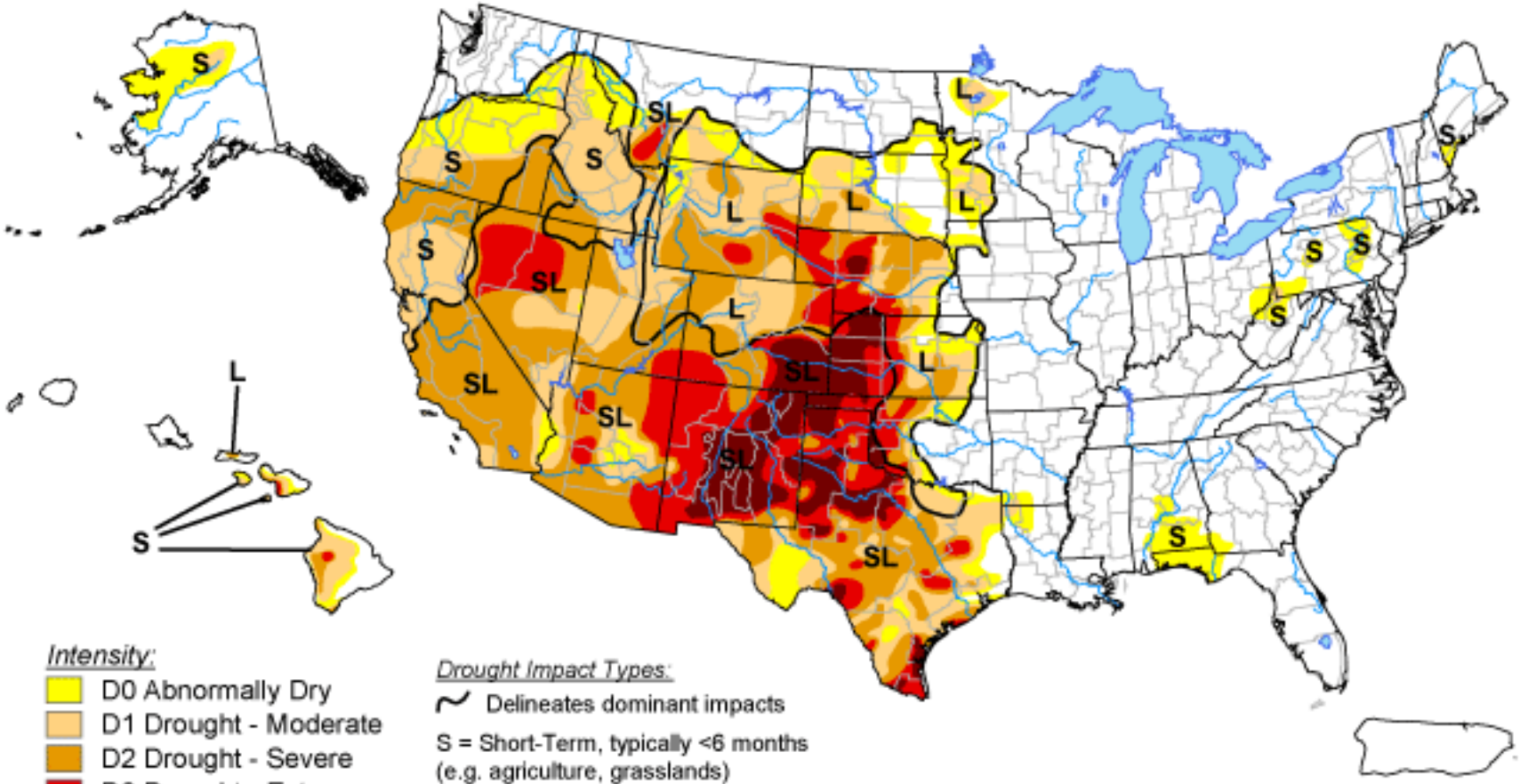

Standardized Precipitation-Evapotranspiration Index, 5-Months Ending in March
Arizona
Winter: Nov-Mar
SPEI
1
0
−1
2000
2010
Data Source: WRCC/UI, Created: 9-16-2013


Arizona Percent Area
100.00%
80.00%
60.00%
40.00%
20.00%
0.00%
D0 x:, y:
D1 x:, y:
D2 x:, y:
D3 x:, y:
D4 x:, y:
2000/01/01
2001/01/01
2002/01/01
2003/01/01
2004/01/01
2005/01/01
2006/01/01
2007/01/01
2008/01/01
2009/01/01
2010/01/01
2011/01/01
2012/01/01
2013/01/01
2014/01/01


New Mexico Percent Area
100.00%
80.00%
60.00%
40.00%
20.00%
0.00%
D0 x:, y:
D1 x:, y:
D2 x:, y:
D3 x:, y:
D4 x:, y:
2000/01/01
2001/01/01
2002/01/01
2003/01/01
2004/01/01
2005/01/01
2006/01/01
2007/01/01
2008/01/01
2009/01/01
2010/01/01
2011/01/01
2012/01/01
2013/01/01
2014/01/01

U.S. Drought Monitor

June 18, 2013
Valid 7 a.m. EDT



Intensity:

- D0 Abnormally Dry
- D1 Drought - Moderate
- D2 Drought - Severe
- D3 Drought - Extreme
- D4 Drought - Exceptional

Drought Impact Types:

Delineates dominant impacts

S = Short-Term, typically <6 months (e.g. agriculture, grasslands)

L = Long-Term, typically >6 months (e.g. hydrology, ecology)

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

http://droughtmonitor.unl.edu/

Released Thursday, June 20, 2013

Author: Mark Svoboda, National Drought Mitigation Center

http://arizonaexperience.org/

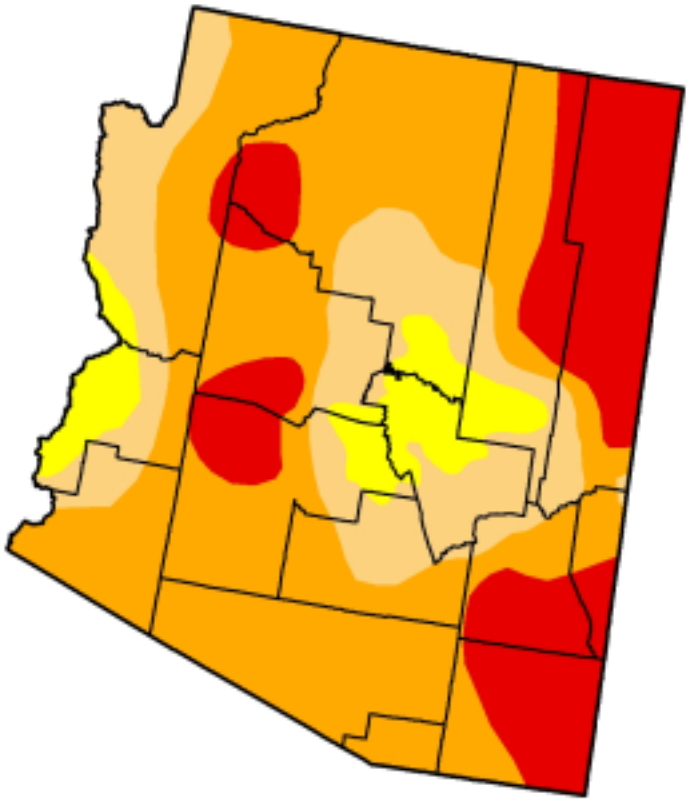
U.S. Drought Monitor

June 18, 2013
Valid 7 a.m. EST

Arizona

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	0.00	100.00	92.49	72.23	22.25	0.00
Last Week (06/11/2013 map)	0.00	100.00	92.49	72.23	19.67	0.00
3 Months Ago (03/19/2013 map)	3.06	96.94	80.11	29.72	2.03	0.00
Start of Calendar Year (01/01/2013 map)	0.00	100.00	97.91	37.78	8.68	0.00
Start of Water Year (09/25/2012 map)	0.00	100.00	100.00	31.93	5.67	0.00
One Year Ago (06/12/2012 map)	0.00	100.00	96.08	83.21	16.29	0.00



Intensity:

- D0 Abnormally Dry
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The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

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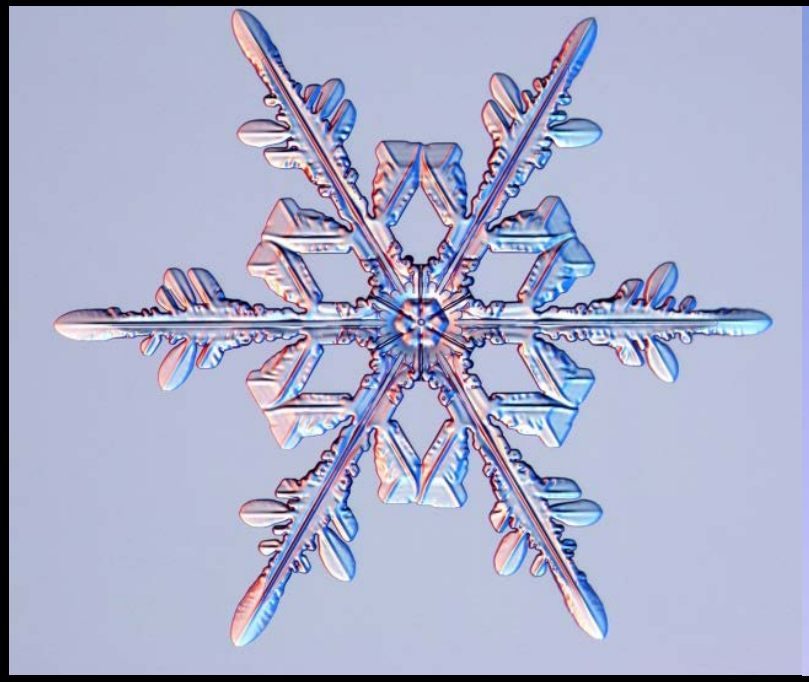
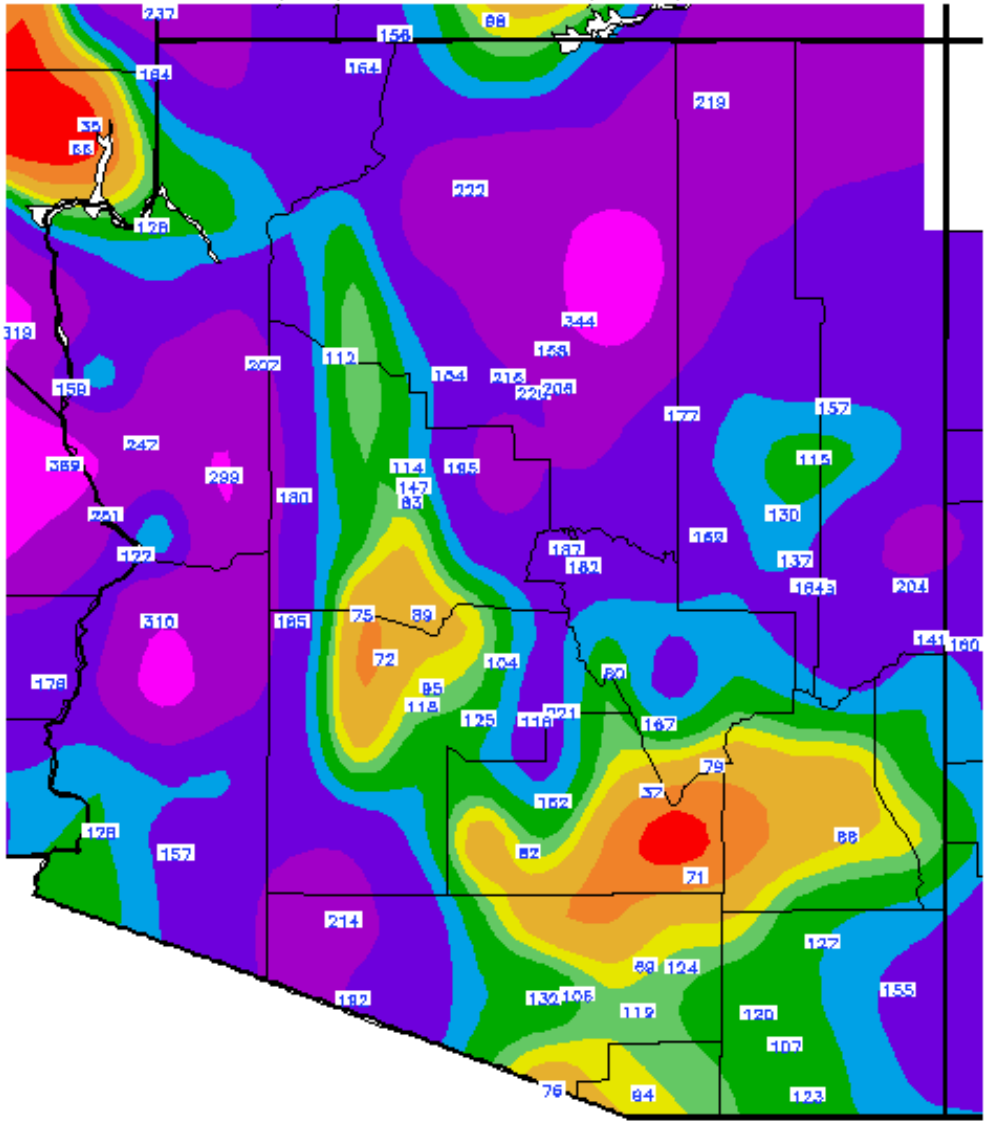
Released Thursday, June 20, 2013
National Drought Mitigation Center,

No 2 monsoons the same

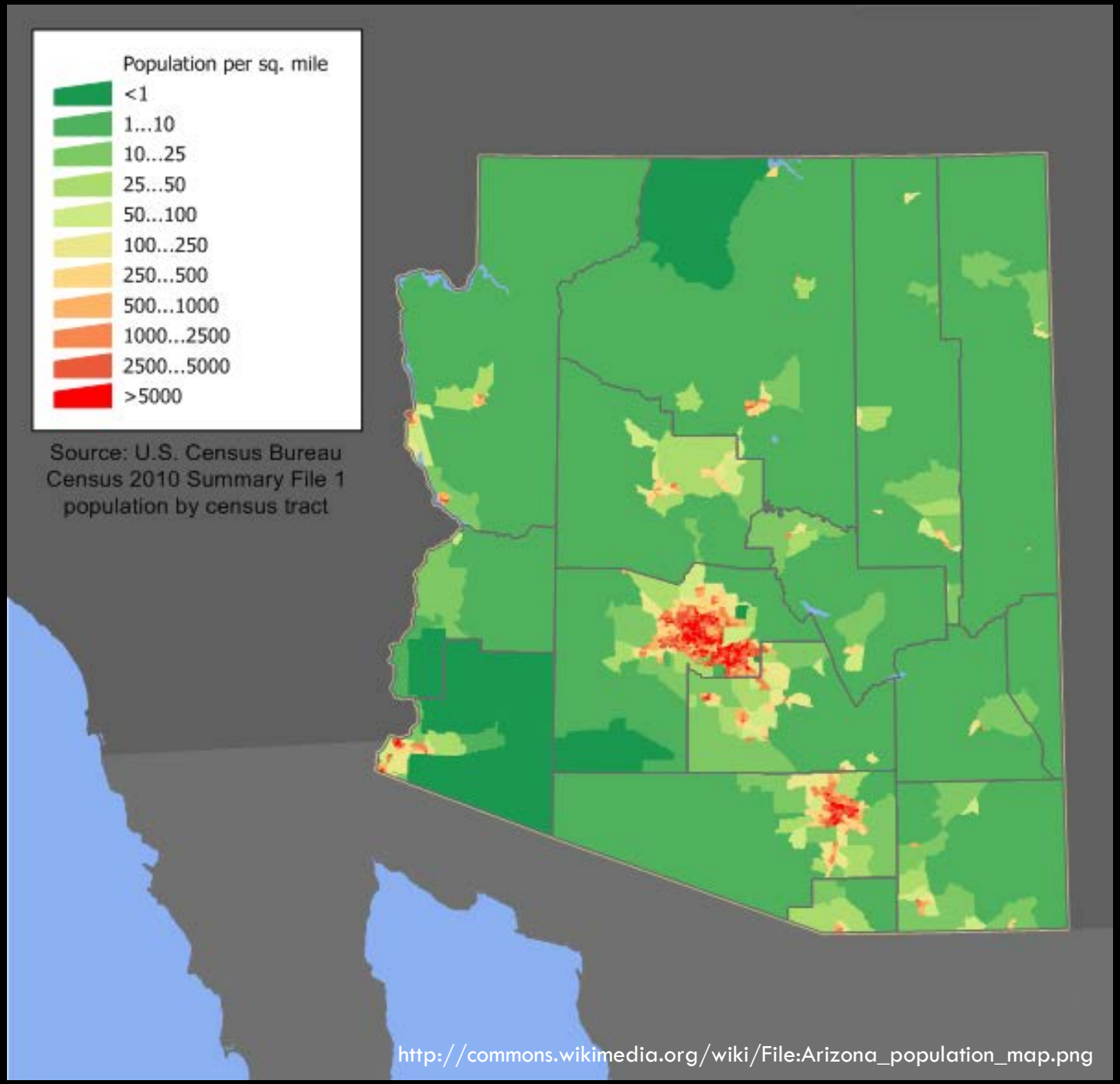


Percent of Average Precipitation (%)
7/1/2013 – 9/15/2013



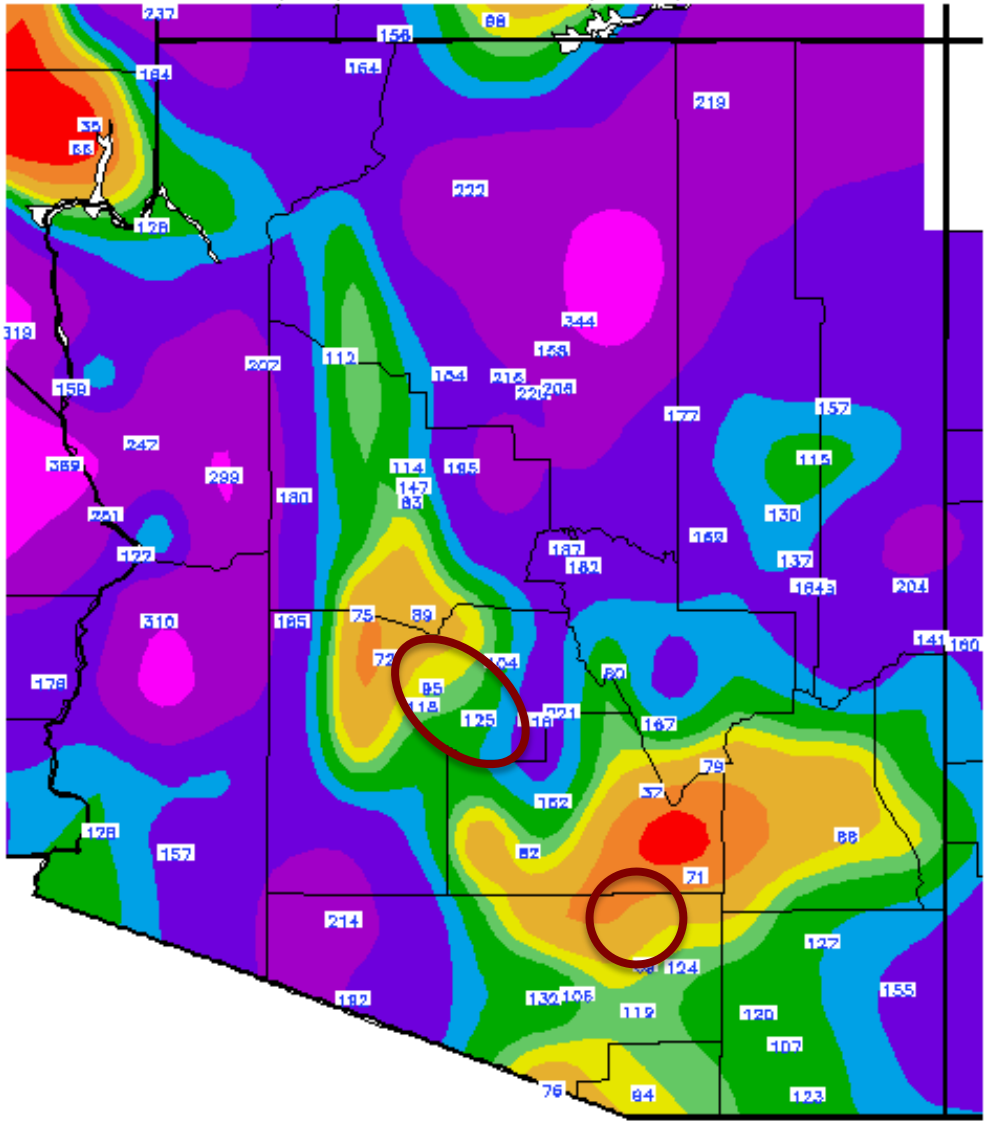
5 25 50 70 90 100 110 130 150 200 300

Generated 9/16/2013 at WRCC using provisional data.
NOAA Regional Climate Centers



http://commons.wikimedia.org/wiki/File:Arizona_population_map.png

Percent of Average Precipitation (%)
7/1/2013 – 9/15/2013

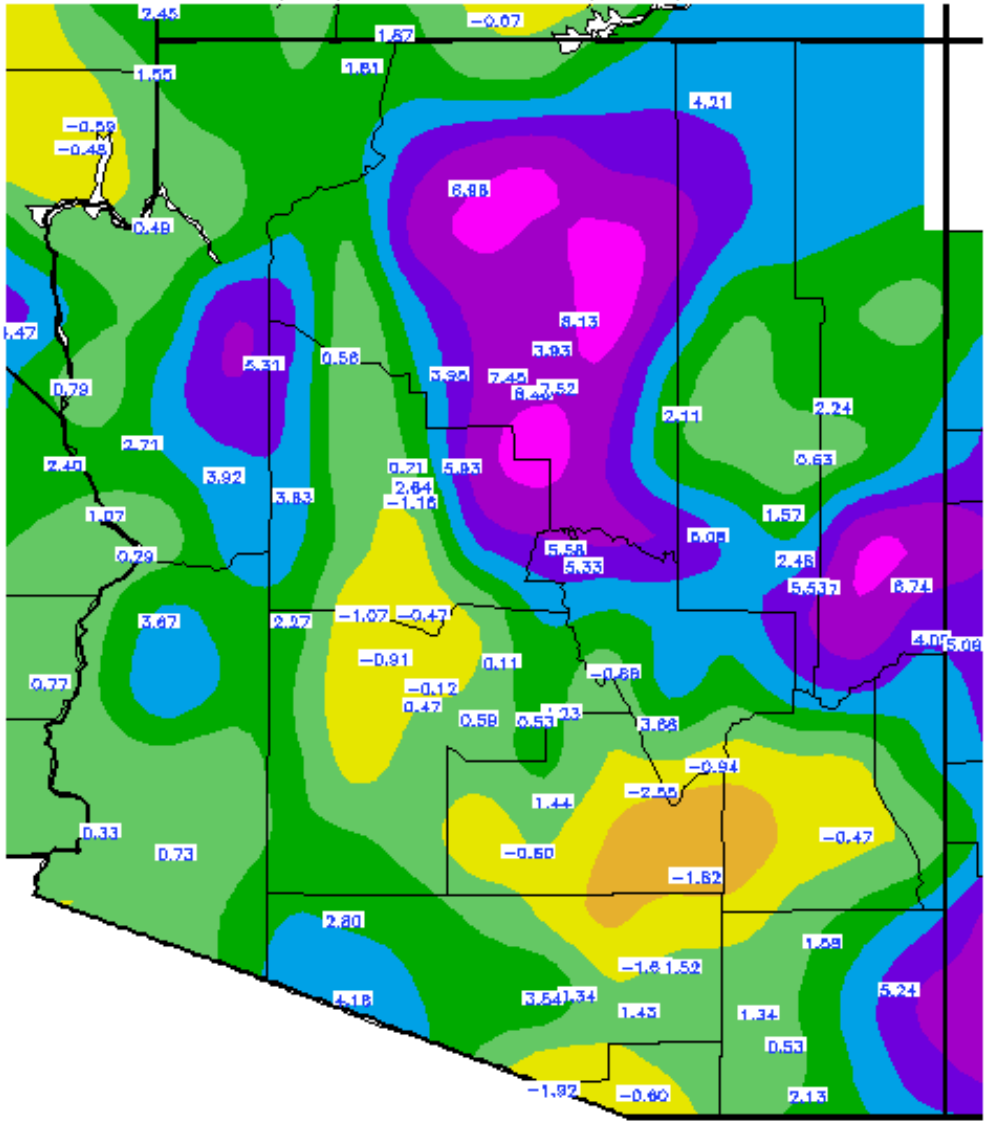


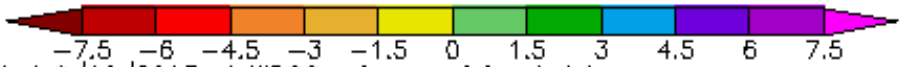
5 25 50 70 90 100 110 130 150 200 300

Generated 9/16/2013 at WRCC using provisional data.
NOAA Regional Climate Centers

Precipitation Departure from Average (in.)

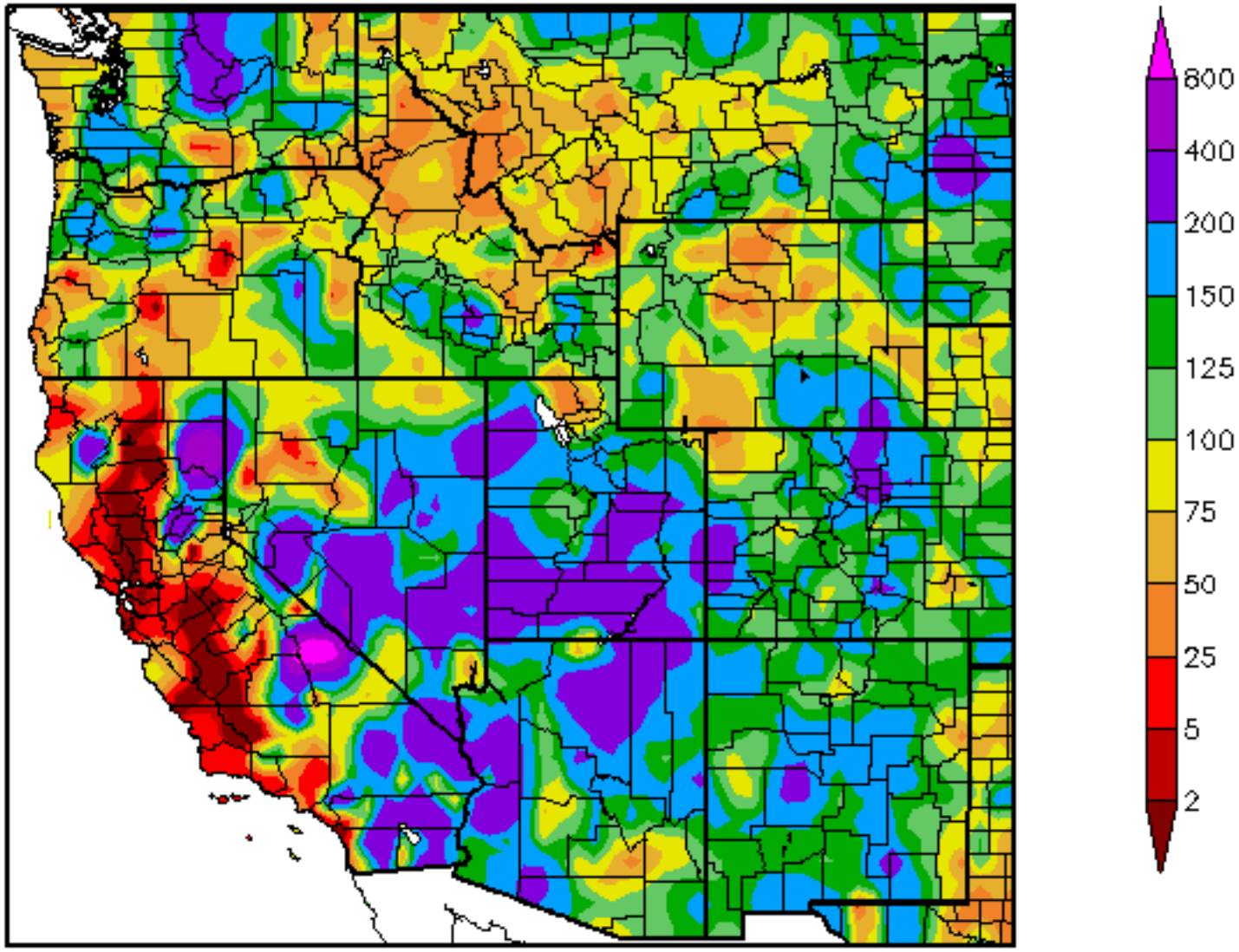
7/1/2013 – 9/15/2013





Generated 9/16/2013 at WRCC using provisional data.
NOAA Regional Climate Centers

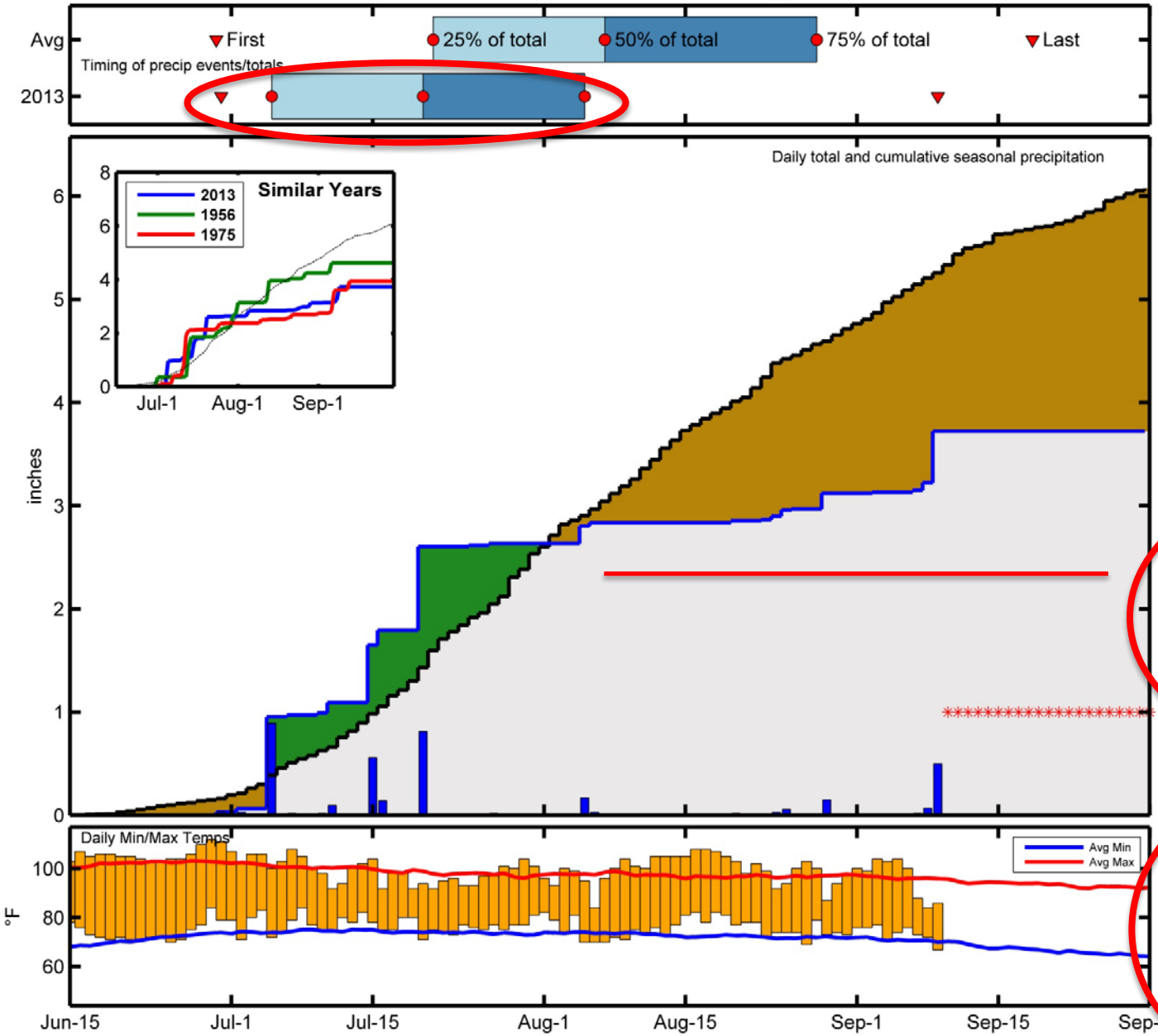
Percent of Normal Precipitation (%)
7/1/2013 – 9/15/2013



Generated 9/16/2013 at HPRCC using provisional data.

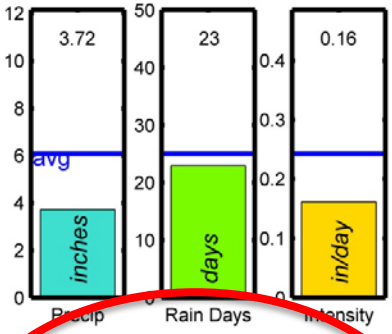
Regional Climate Centers

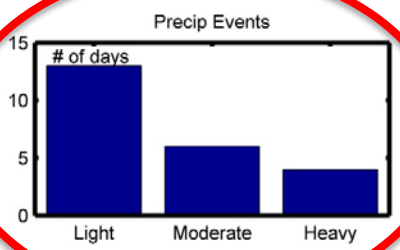
2013 Monsoon Summary



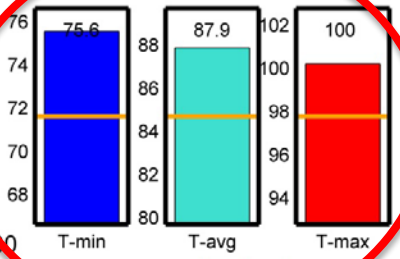
TUCSON INTL AP

Elevation: 777m
Period of record: 1950-2013
Years in record: 64
Precip rank: 54 (1,wettest)
Temp rank: 2 (1,warmest)
Missing in 2013: 21 days





Dry Spells
Avg length: 4 days (avg: 5)
Max length: 13 days (avg: 14)



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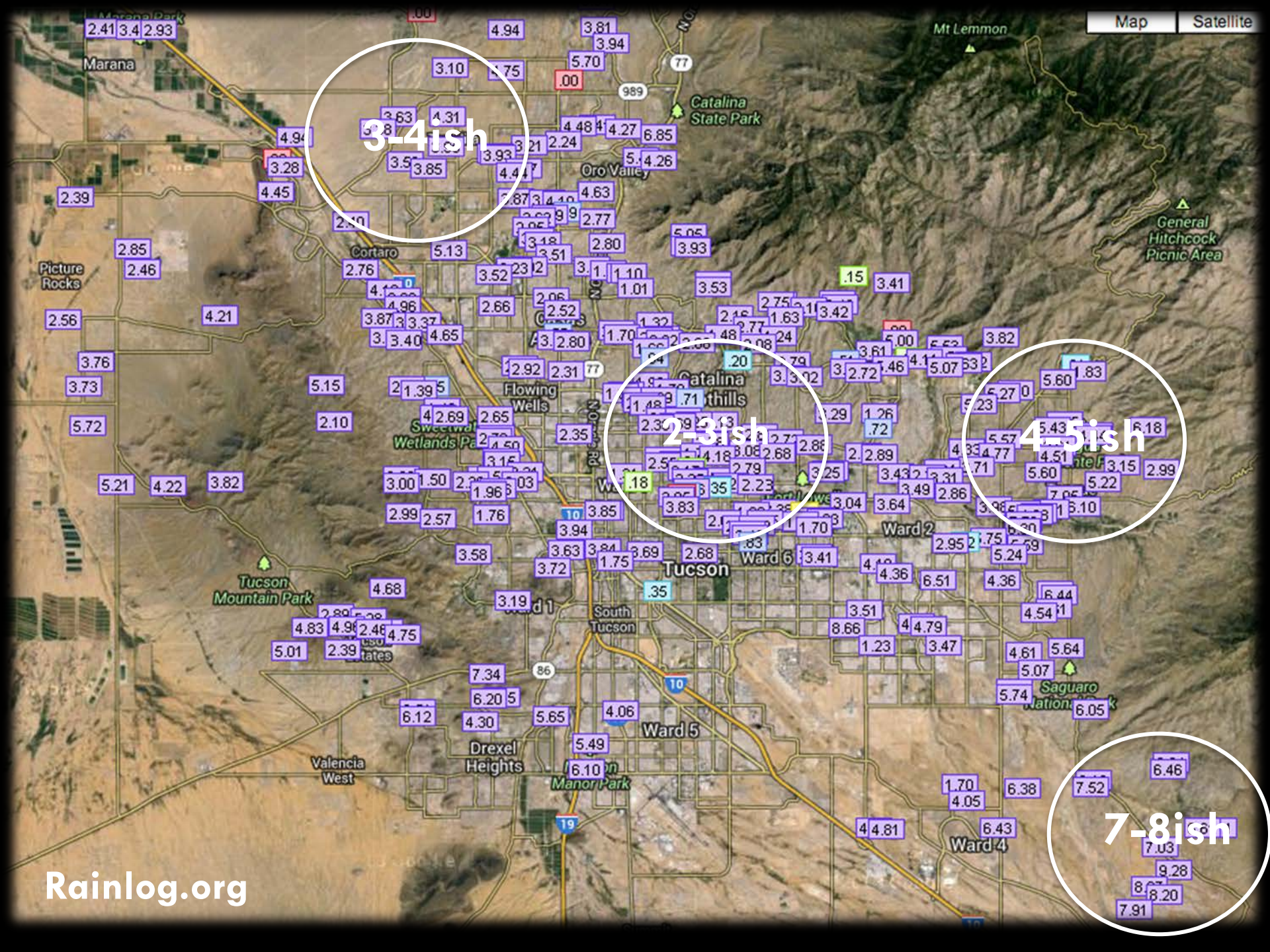
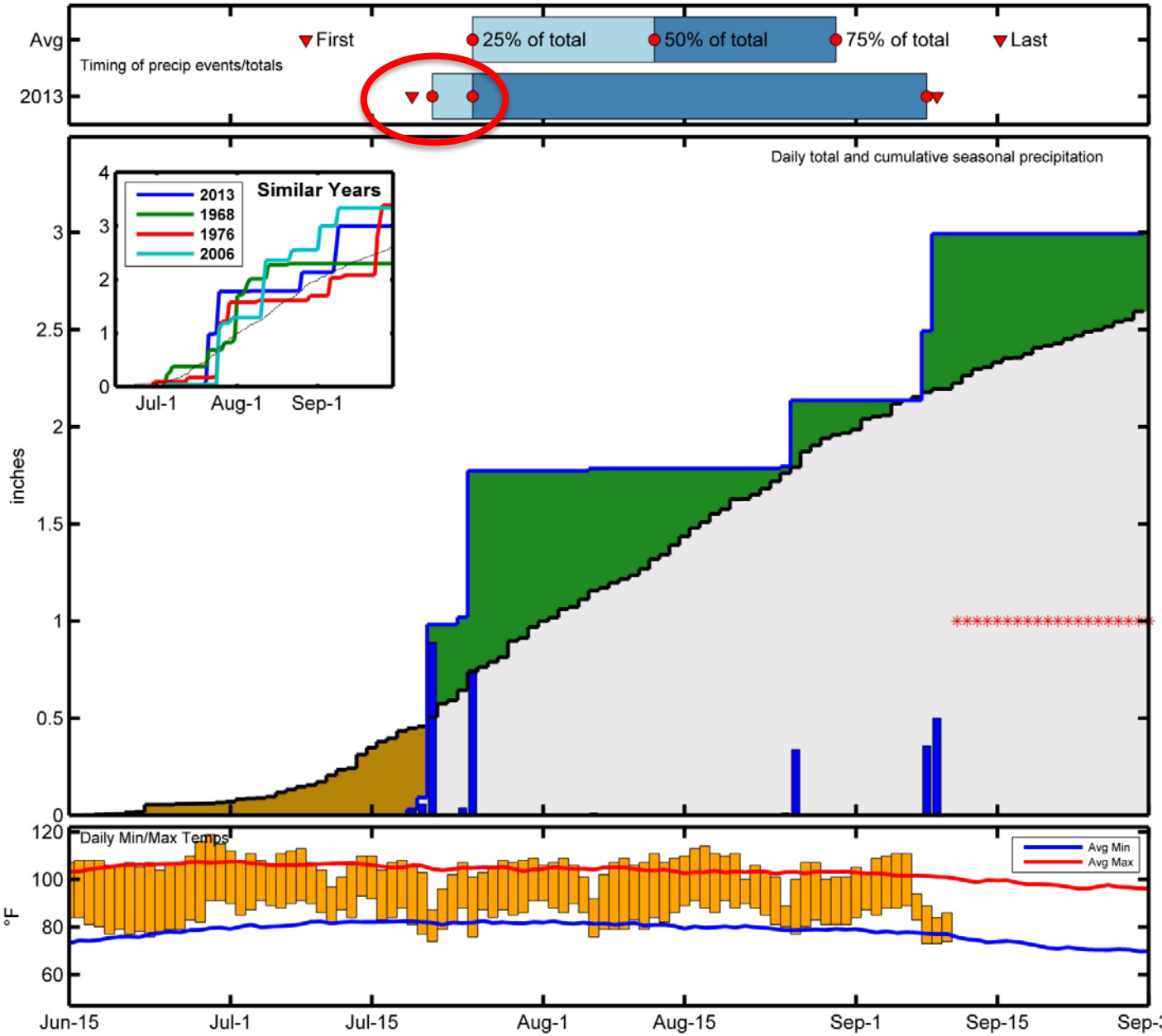
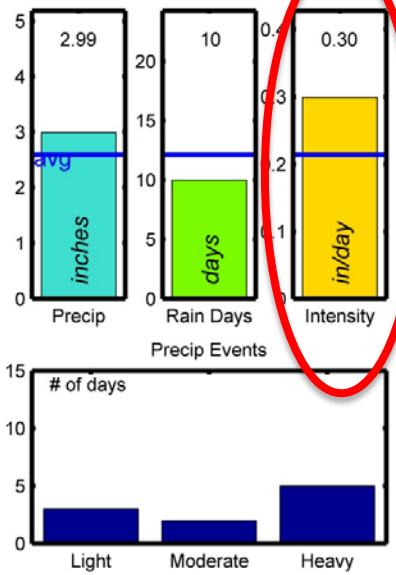

Map
Satellite
3-4ish
2-3ish
4-5ish
7-8ish
Rainlog.org
Marana
Picture Rocks
Cortaro
Oro Valley
Catalina State Park
Mt Lemmon
General Hitchcock Picnic Area
Flowing Wells
Catalina Foothills
Tucson
Ward 1
Ward 2
Ward 4
Ward 5
Ward 6
South Tucson
Tucson Mountain Park
Drexel Heights
Valencia West
Manor Park
Saguaro National Park

2013 Monsoon Summary

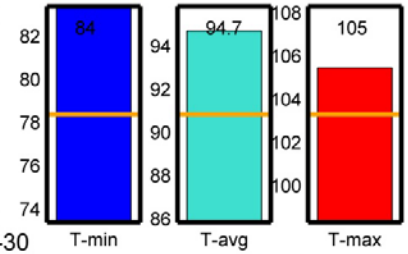


PHOENIX SKY HARBOR INTL AP

Elevation: 337m
Period of record: 1950-2013
Years in record: 64
Precip rank: 21 (1,wettest)
Temp rank: 2 (1,warmest)
Missing in 2013: 20 days



Dry Spells
Avg length: 15 days (avg: 11)
Max length: 18 days (avg: 21)



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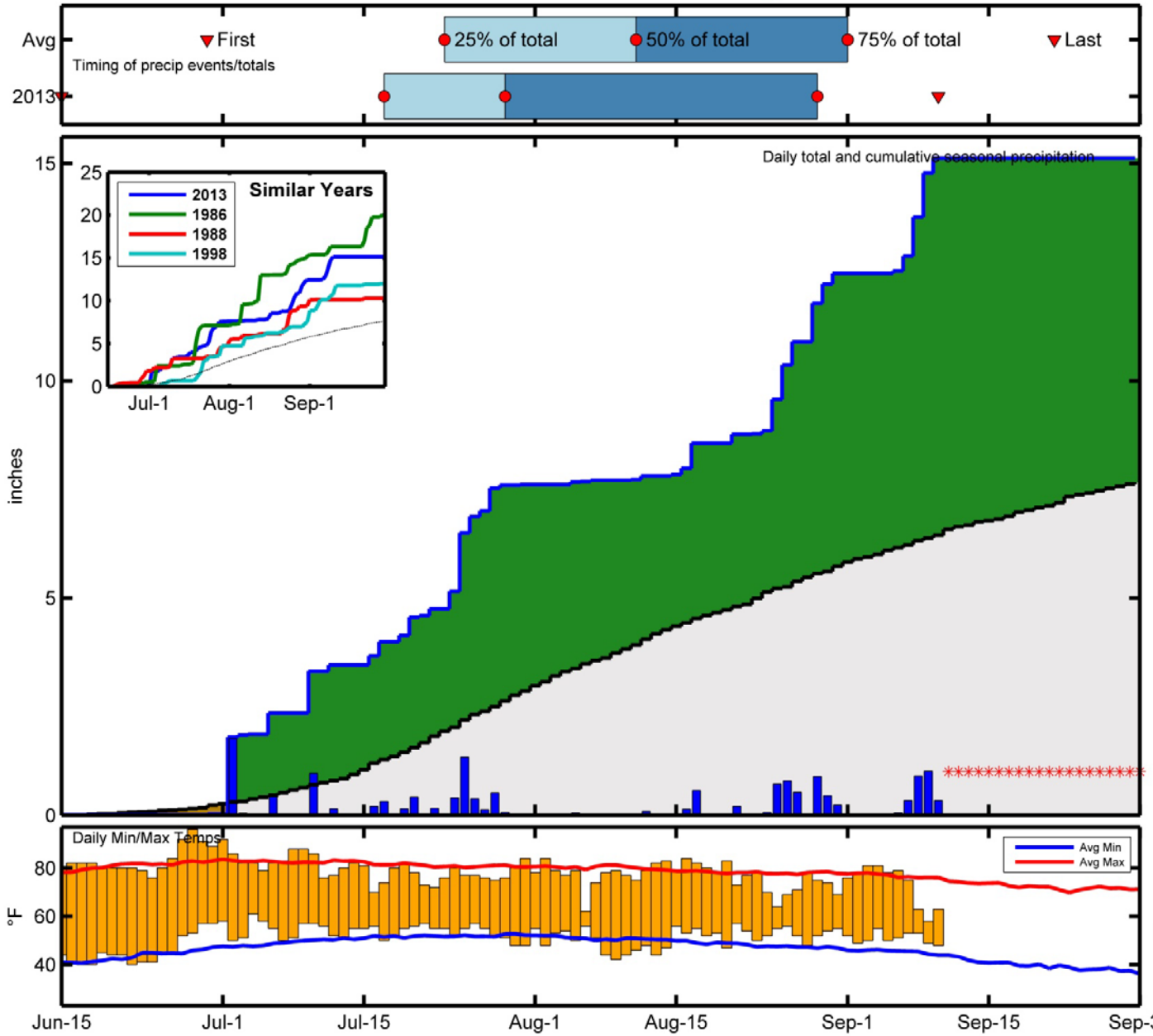
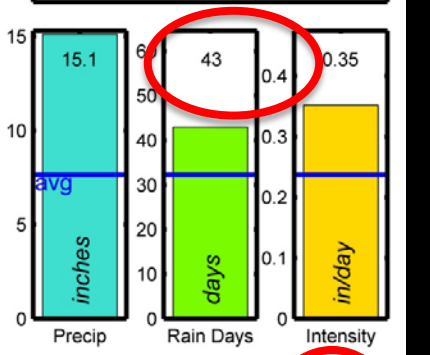
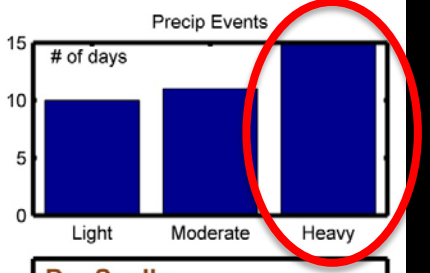


FLAGSTAFF PULLIAM AP

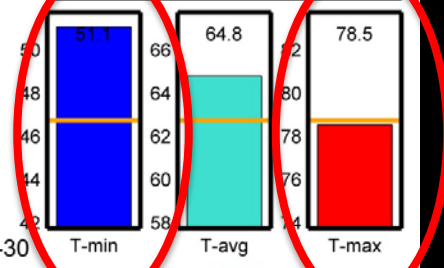
Elevation: 2135m
Period of record: 1950-2013
Years in record: 64
Precip rank: 2 (1,wettest)
Temp rank: 2 (1,warmest)
Missing in 2013: 20 days





Dry Spells

Avg length: 3 days (avg: 5)
Max length: 14 days (avg: 13)



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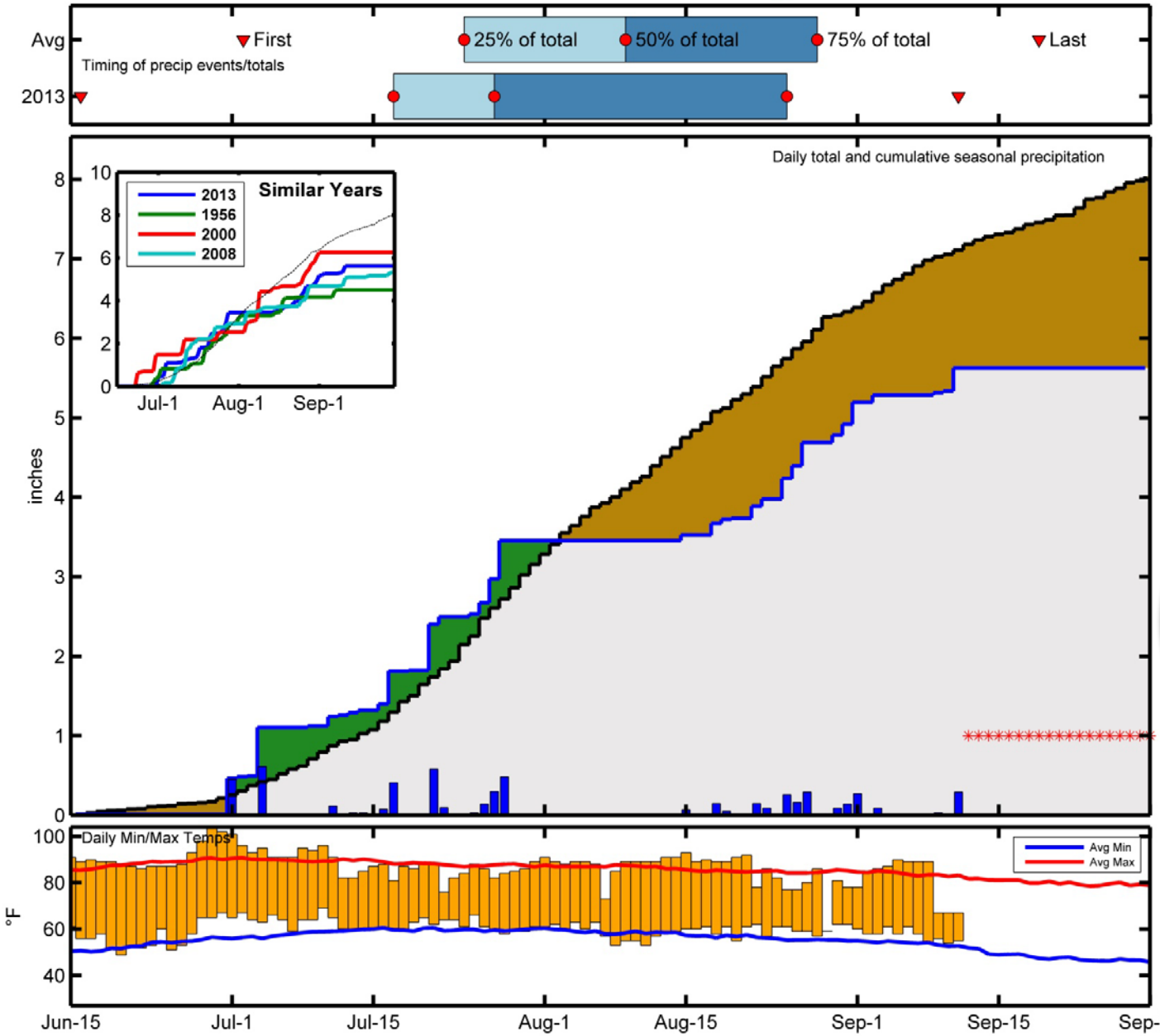
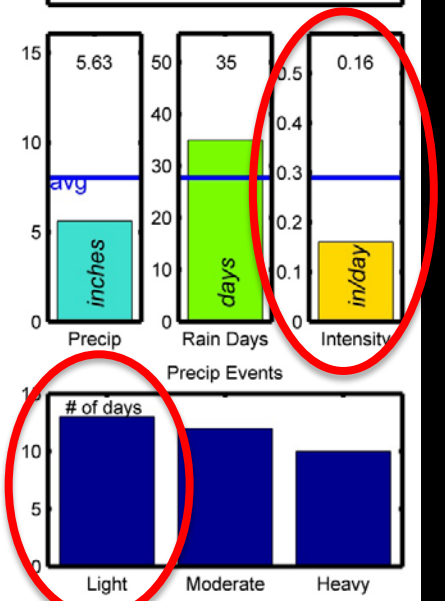
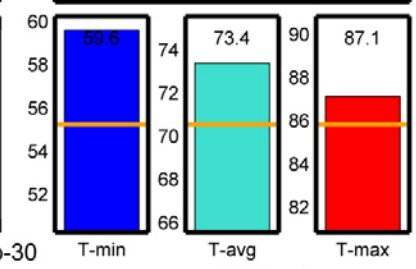


PRESCOTT

Elevation: 1587m
Period of record: 1950-2013
Years in record: 64
Precip rank: 48 (1,wettest)
Temp rank: 4 (1,warmest)
Missing in 2013: 19 days



Dry Spells
Avg length: 4 days (avg: 6)
Max length: 17 days (avg: 14)



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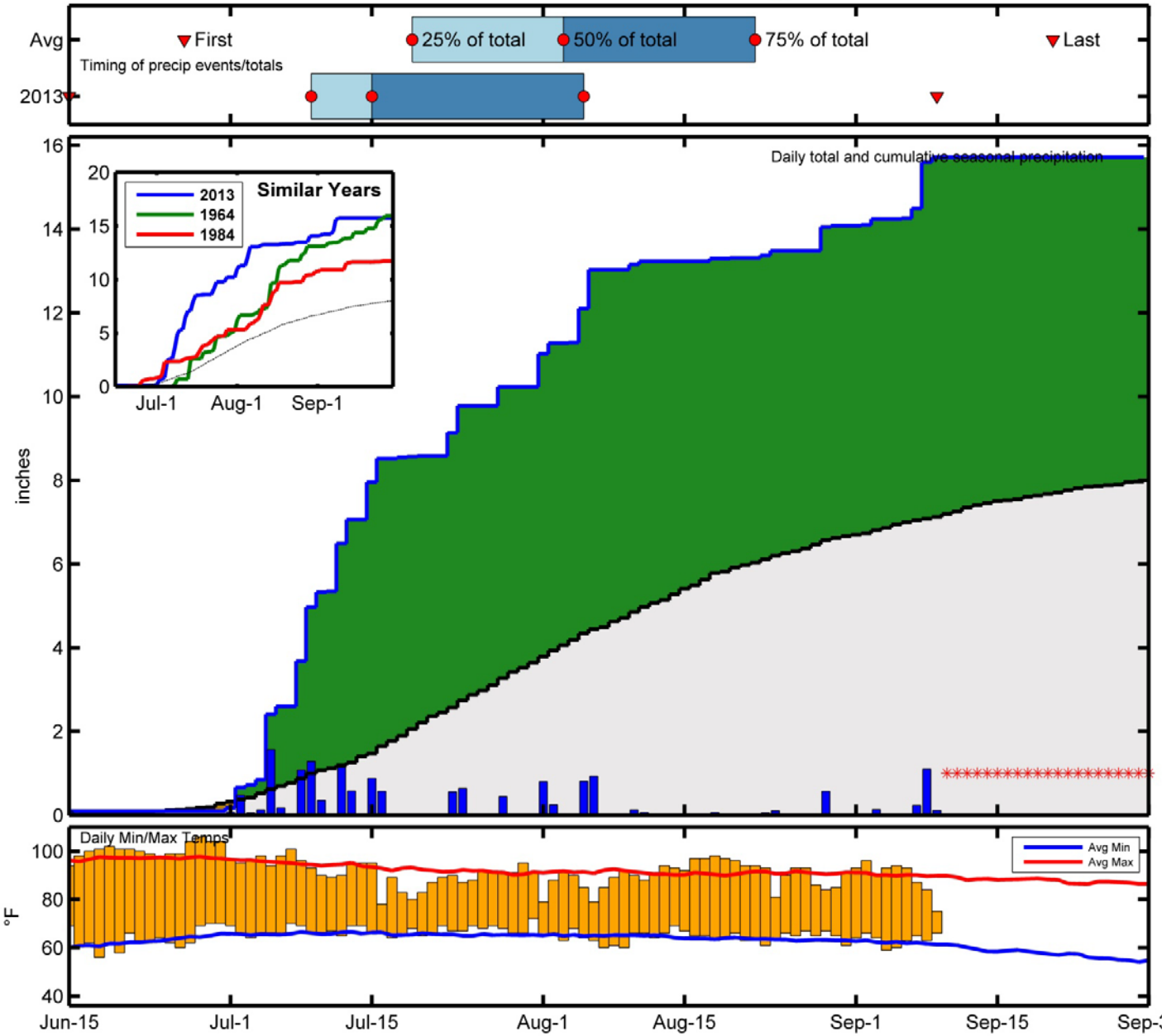
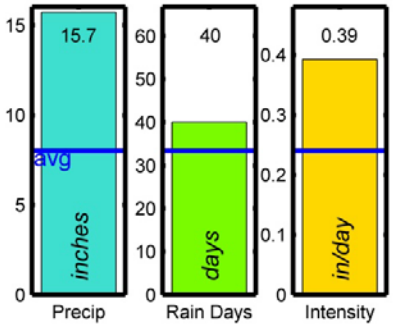
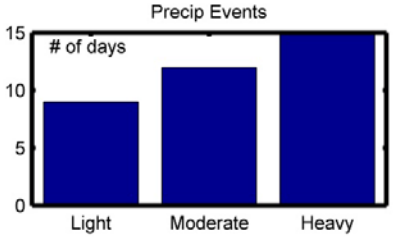
2013 Monsoon Summary

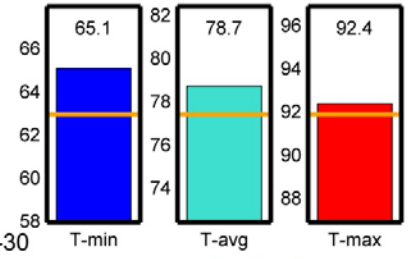


DOUGLAS BISBEE INL AP
Elevation: 1251m
Period of record: 1950-2013
Years in record: 64
Precip rank: 2 (1,wettest)
Temp rank: 11 (1,warmest)
Missing in 2013: 21 days





Dry Spells
Avg length: 3 days (avg: 4)
Max length: 15 days (avg: 13)



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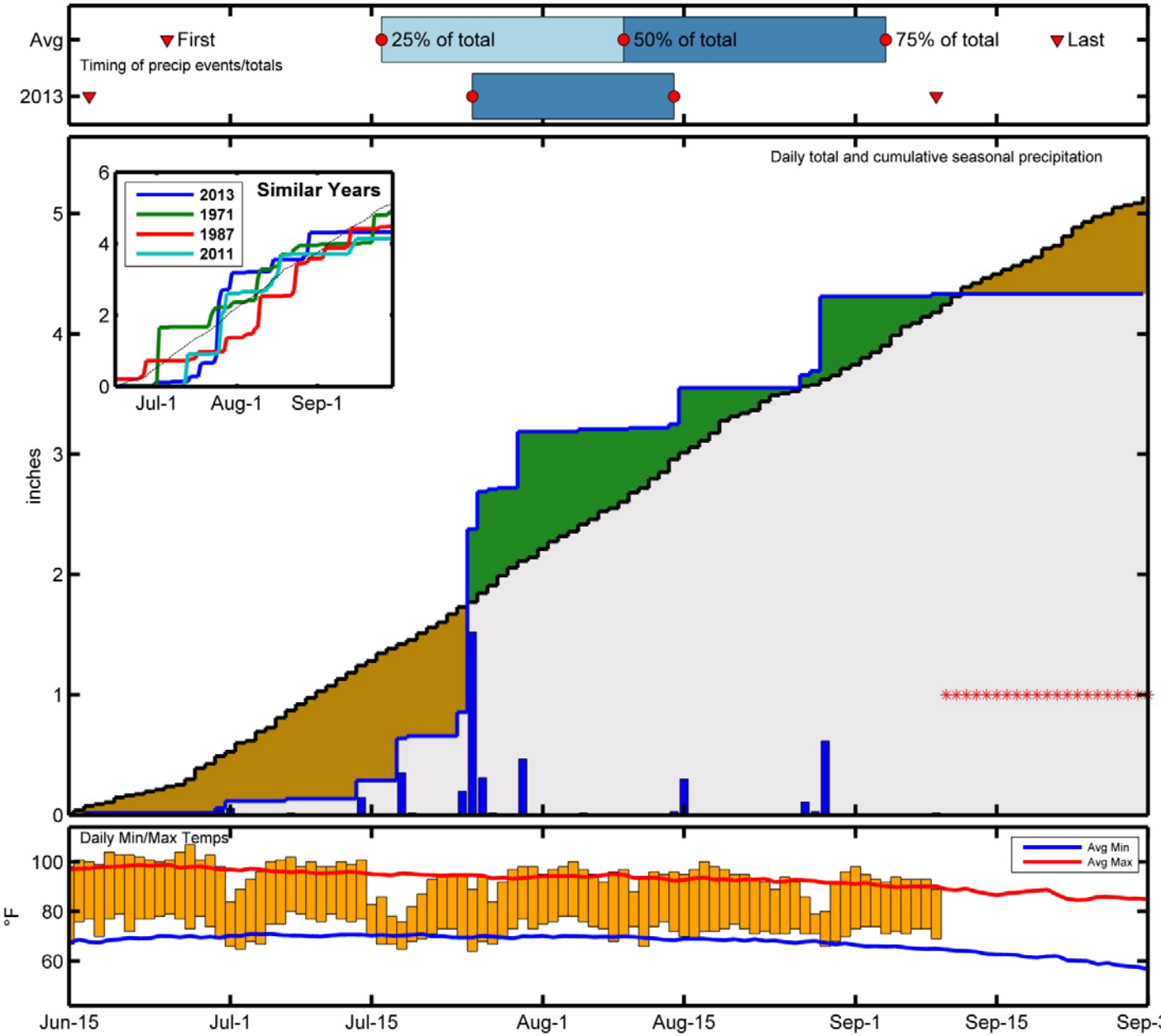
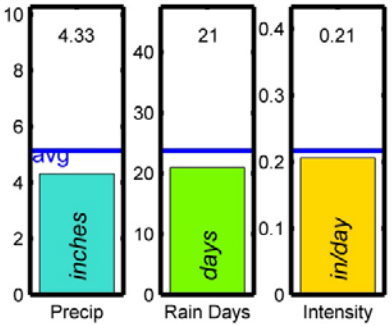
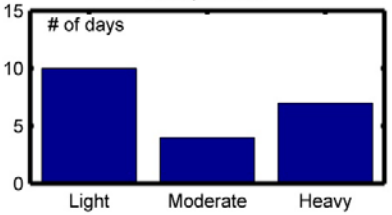


EL PASO INTL AP

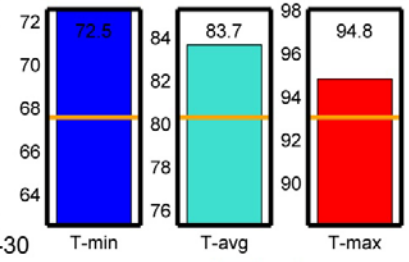
Elevation: 1194m
Period of record: 1950-2013
Years in record: 64
Precip rank: 36.5 (1,wettest)
Temp rank: 3 (1,warmest)
Missing in 2013: 21 days



Precip Events



Dry Spells
Avg length: 6 days (avg: 6)
Max length: 12 days (avg: 17)



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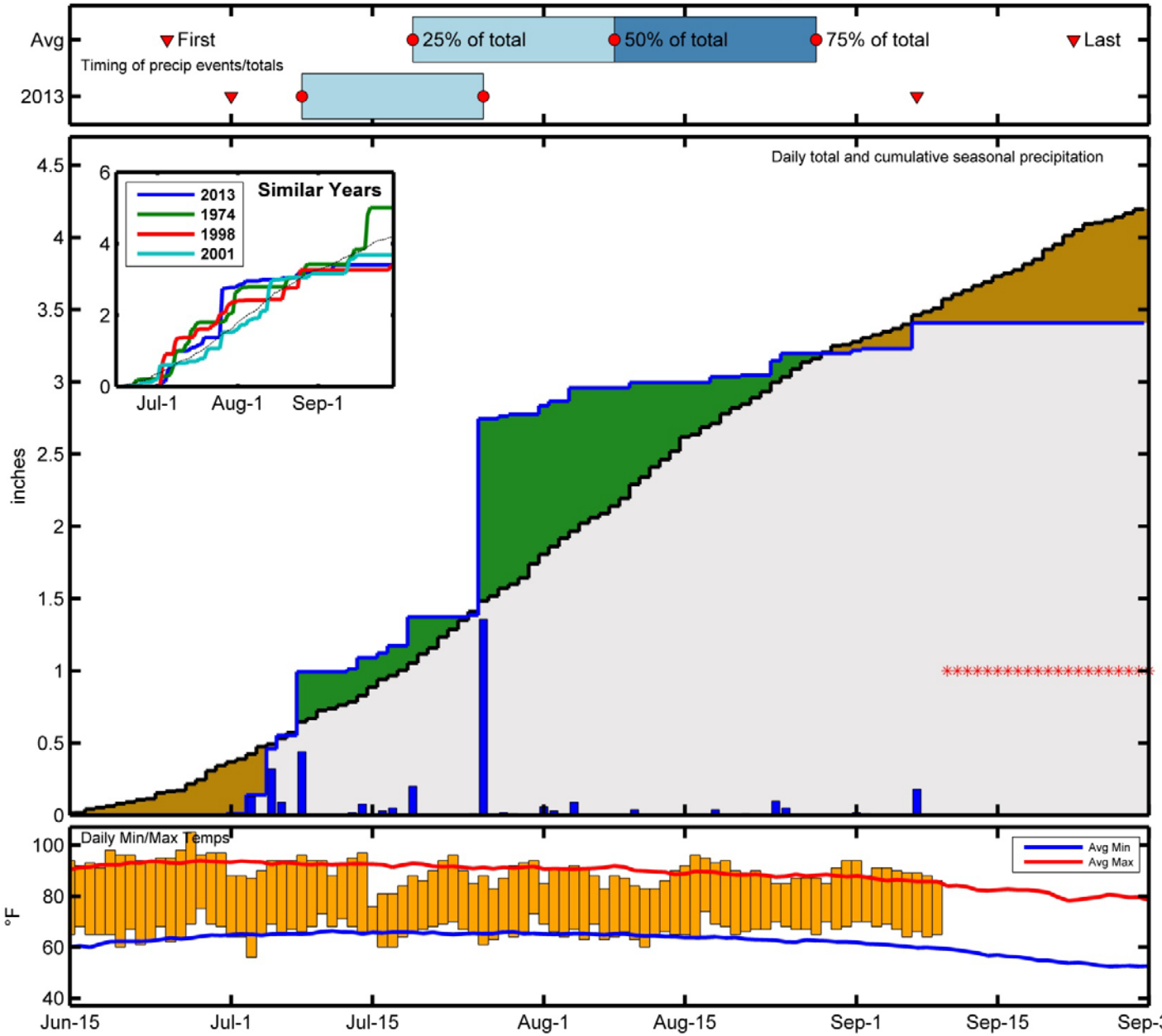
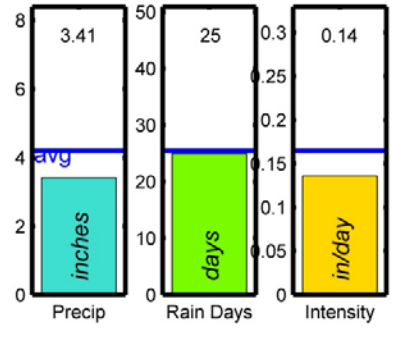
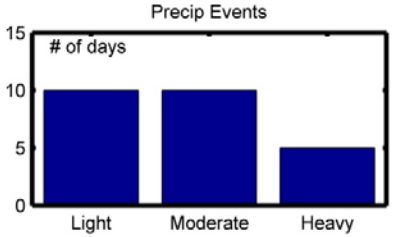
2013 Monsoon Summary



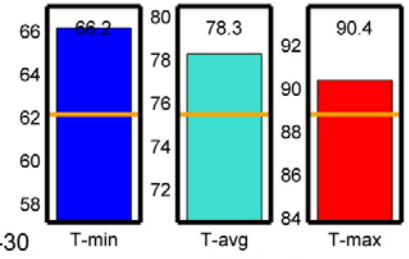
ALBUQUERQUE INTL AP

Elevation: 1619m
Period of record: 1950-2013
Years in record: 64
Precip rank: 45.5 (1,wettest)
Temp rank: 1 (1,warmest)
Missing in 2013: 21 days





Dry Spells
Avg length: 4 days (avg: 5)
Max length: 7 days (avg: 16)



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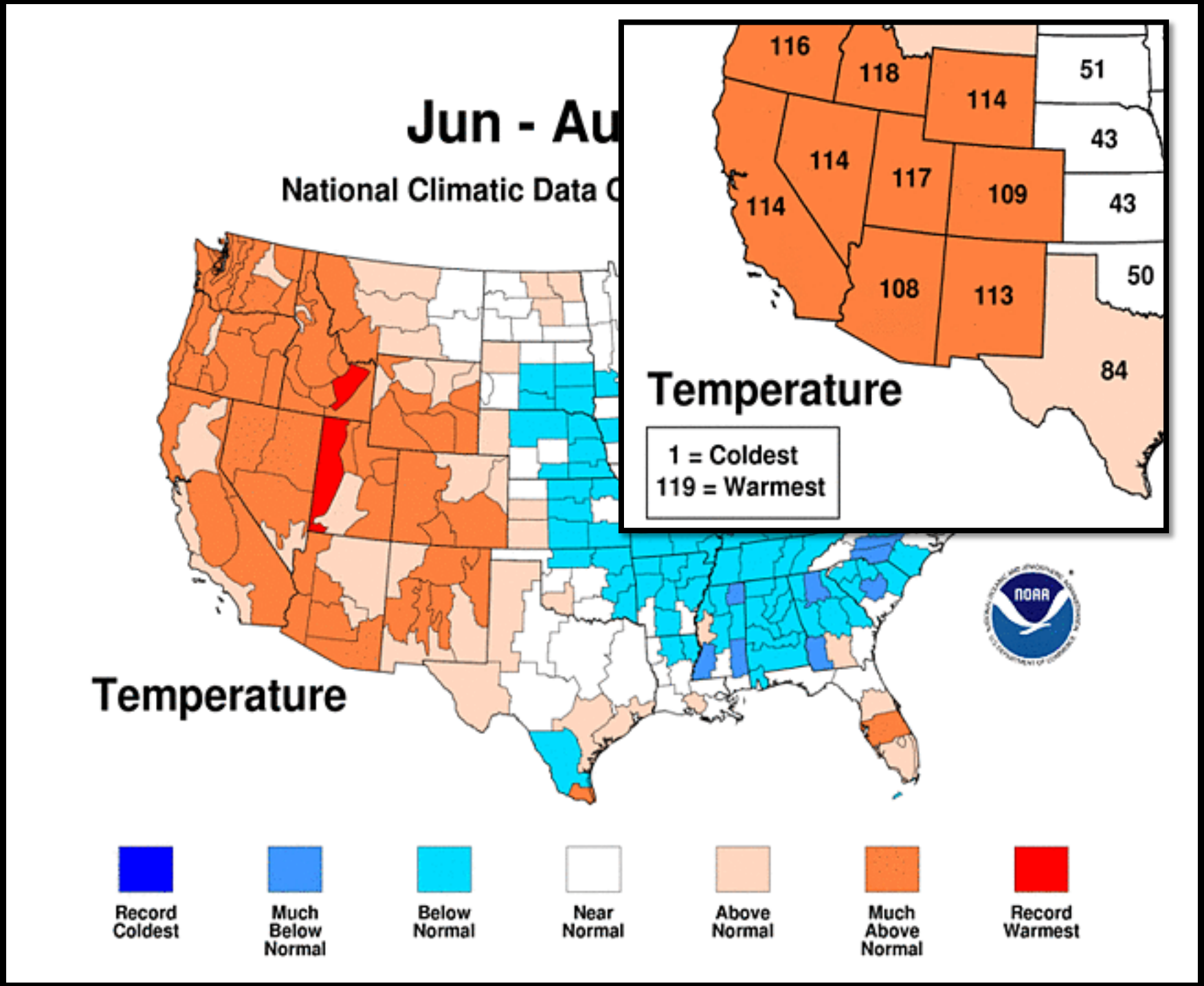
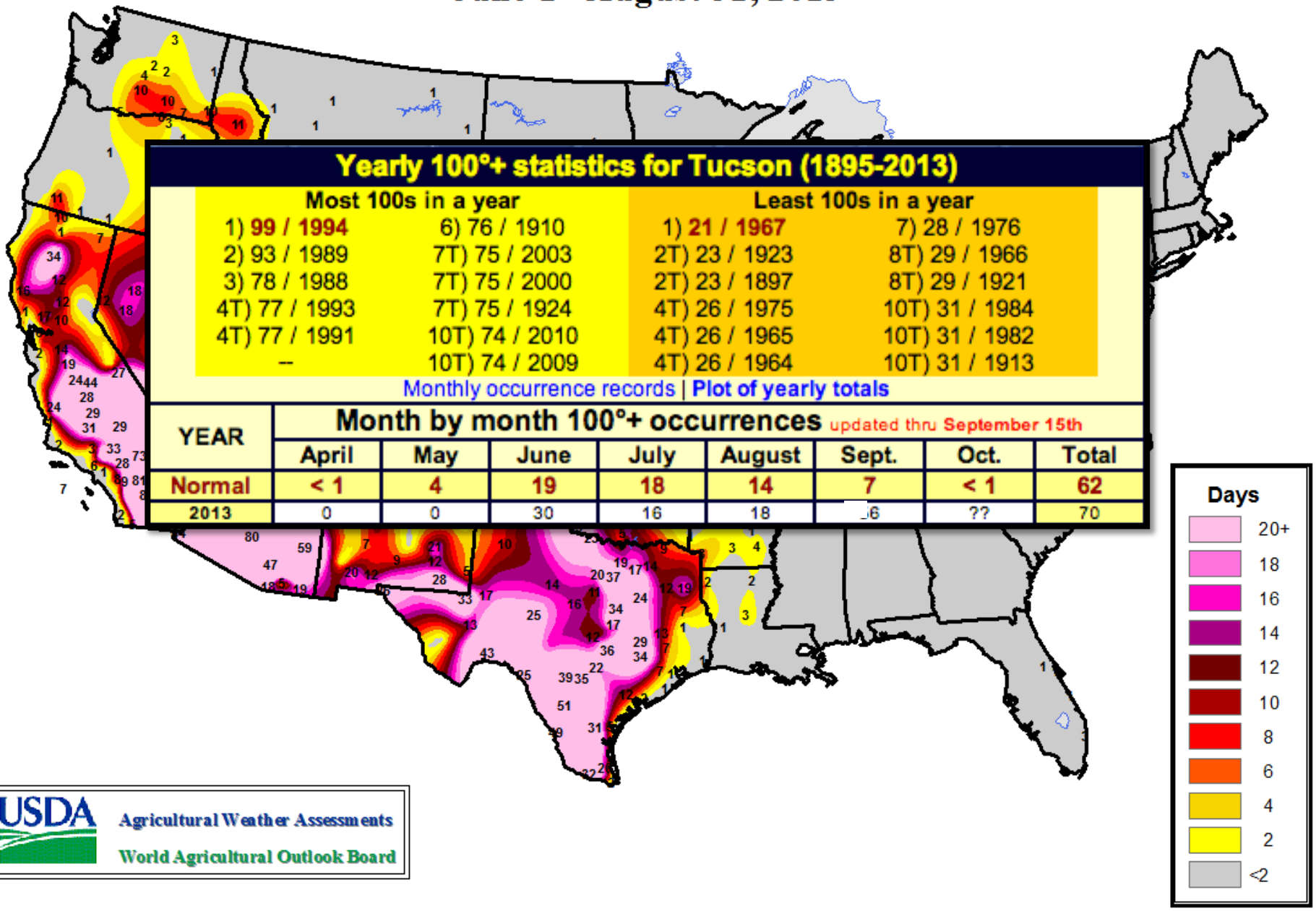

Jun - Au
National Climatic Data C
Temperature
116
118
114
51
114
117
43
114
109
43
108
113
50
84
Temperature
1 = Coldest
119 = Warmest
NOAA
Record Coldest
Much Below Normal
Below Normal
Near Normal
Above Normal
Much Above Normal
Record Warmest

Number of Days >= 100°F

June 1 - August 31, 2013



Yearly 100°+ statistics for Tucson (1895-2013)

Most 100s in a year		Least 100s in a year	
1) 99 / 1994	6) 76 / 1910	1) 21 / 1967	7) 28 / 1976
2) 93 / 1989	7T) 75 / 2003	2T) 23 / 1923	8T) 29 / 1966
3) 78 / 1988	7T) 75 / 2000	2T) 23 / 1897	8T) 29 / 1921
4T) 77 / 1993	7T) 75 / 1924	4T) 26 / 1975	10T) 31 / 1984
4T) 77 / 1991	10T) 74 / 2010	4T) 26 / 1965	10T) 31 / 1982
–	10T) 74 / 2009	4T) 26 / 1964	10T) 31 / 1913

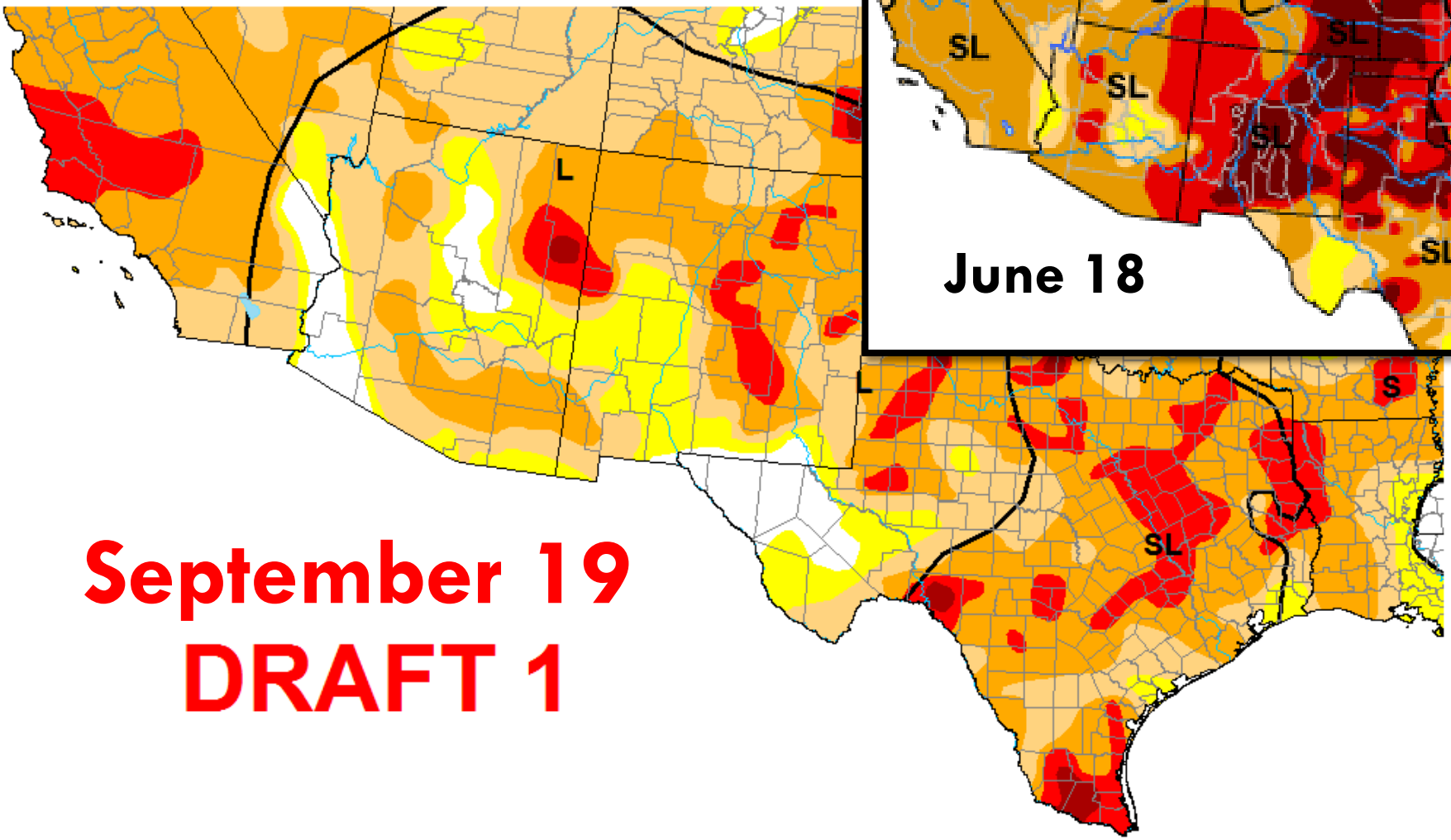
Monthly occurrence records | Plot of yearly totals

Month by month 100°+ occurrences updated thru September 15th

YEAR	April	May	June	July	August	Sept.	Oct.	Total
Normal	< 1	4	19	18	14	7	< 1	62
2013	0	0	30	16	18	6	??	70

USDA Agricultural Weather Assessments
World Agricultural Outlook Board

U.S. Drought Monitor



September 19
DRAFT 1

Intensity:

- D0 Abnormally Dry
- D1 Drought - Moderate
- D2 Drought - Severe
- D3 Drought - Extreme
- D4 Drought - Exceptional

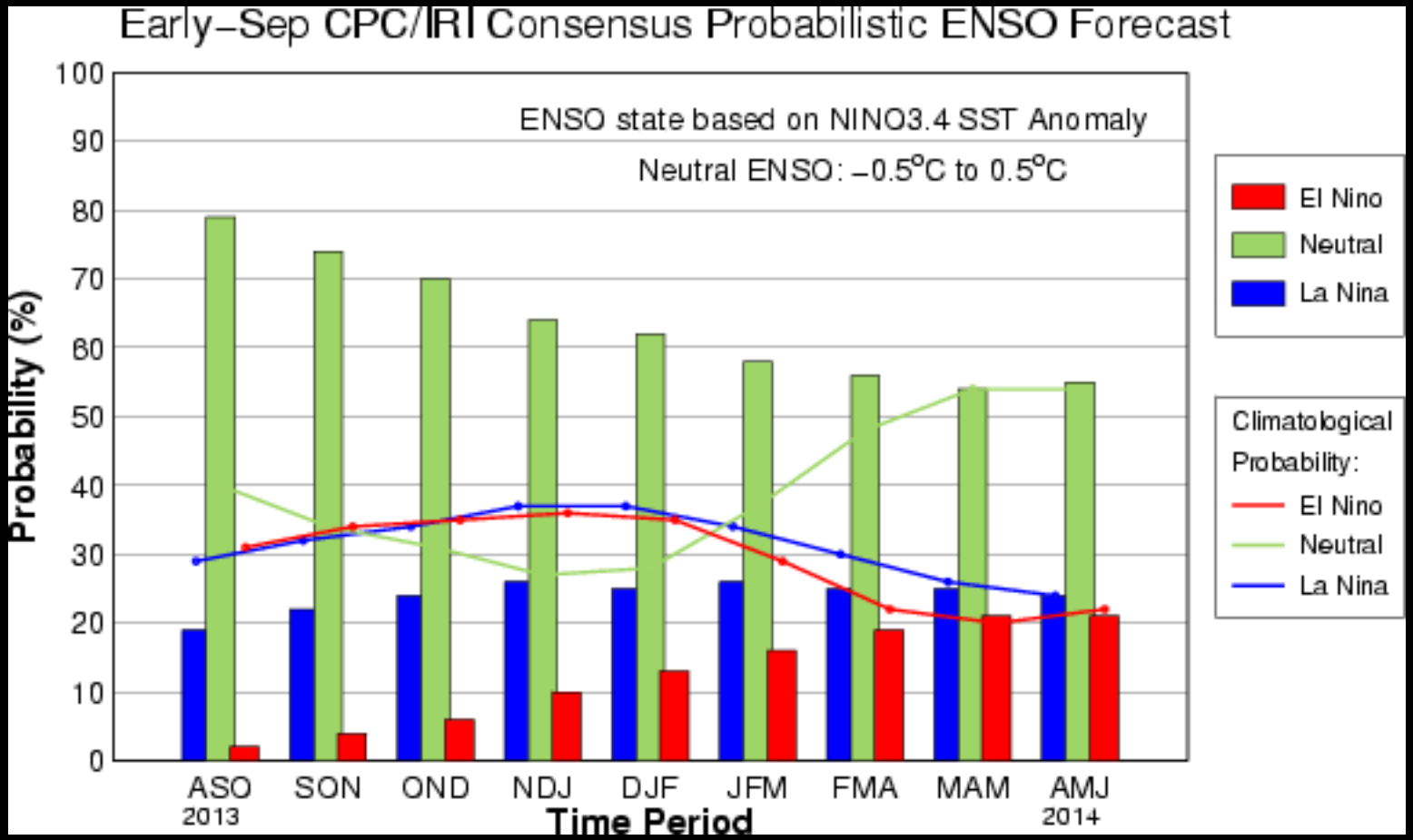
Drought Impact Types:

Delineates dominant impacts

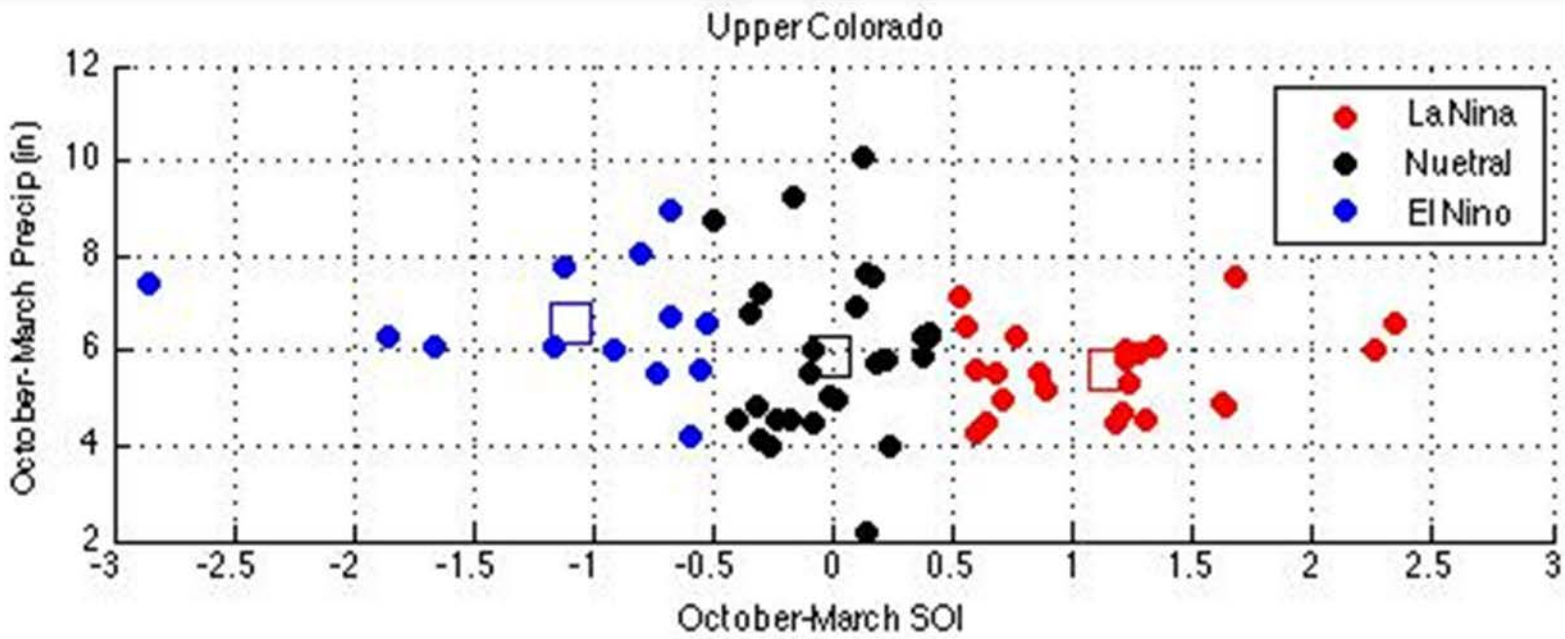
S = Short-Term, typically <6 months (e.g. agriculture, grasslands)

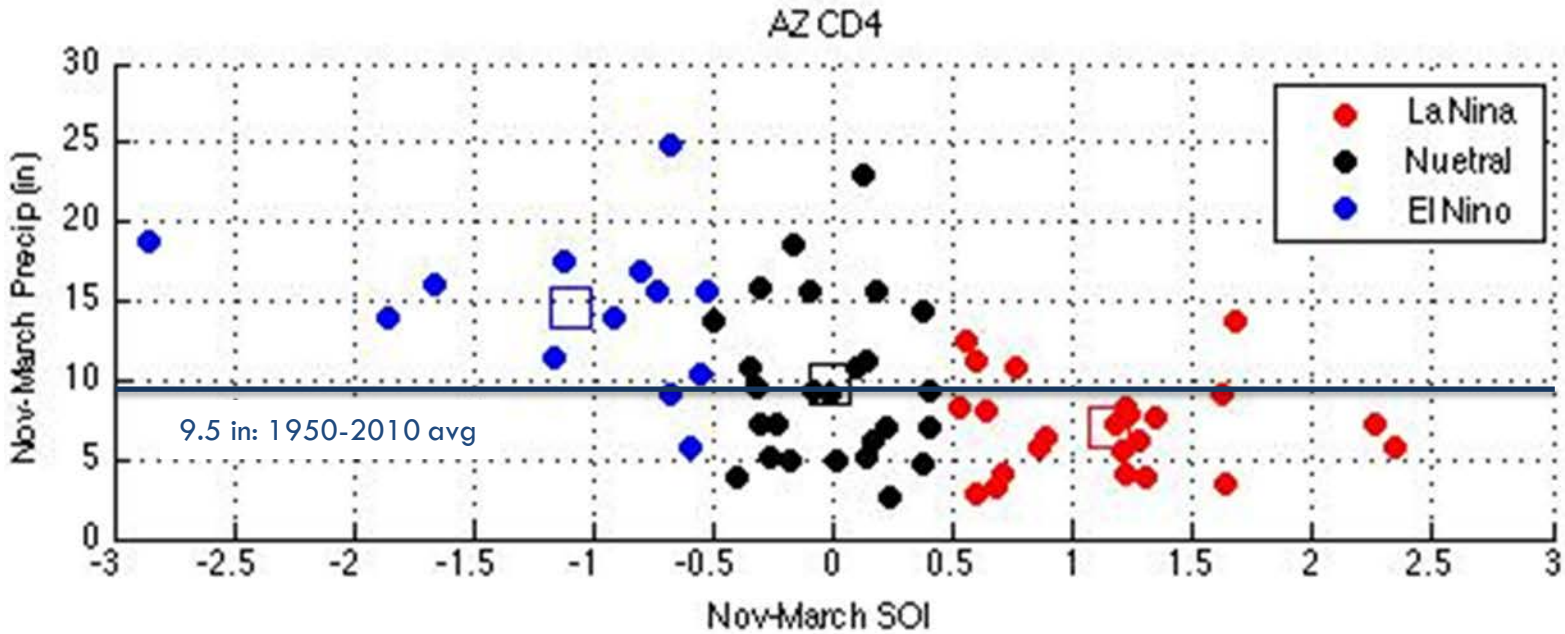
L = Long-Term, typically >6 months (e.g. hydrology, ecology)

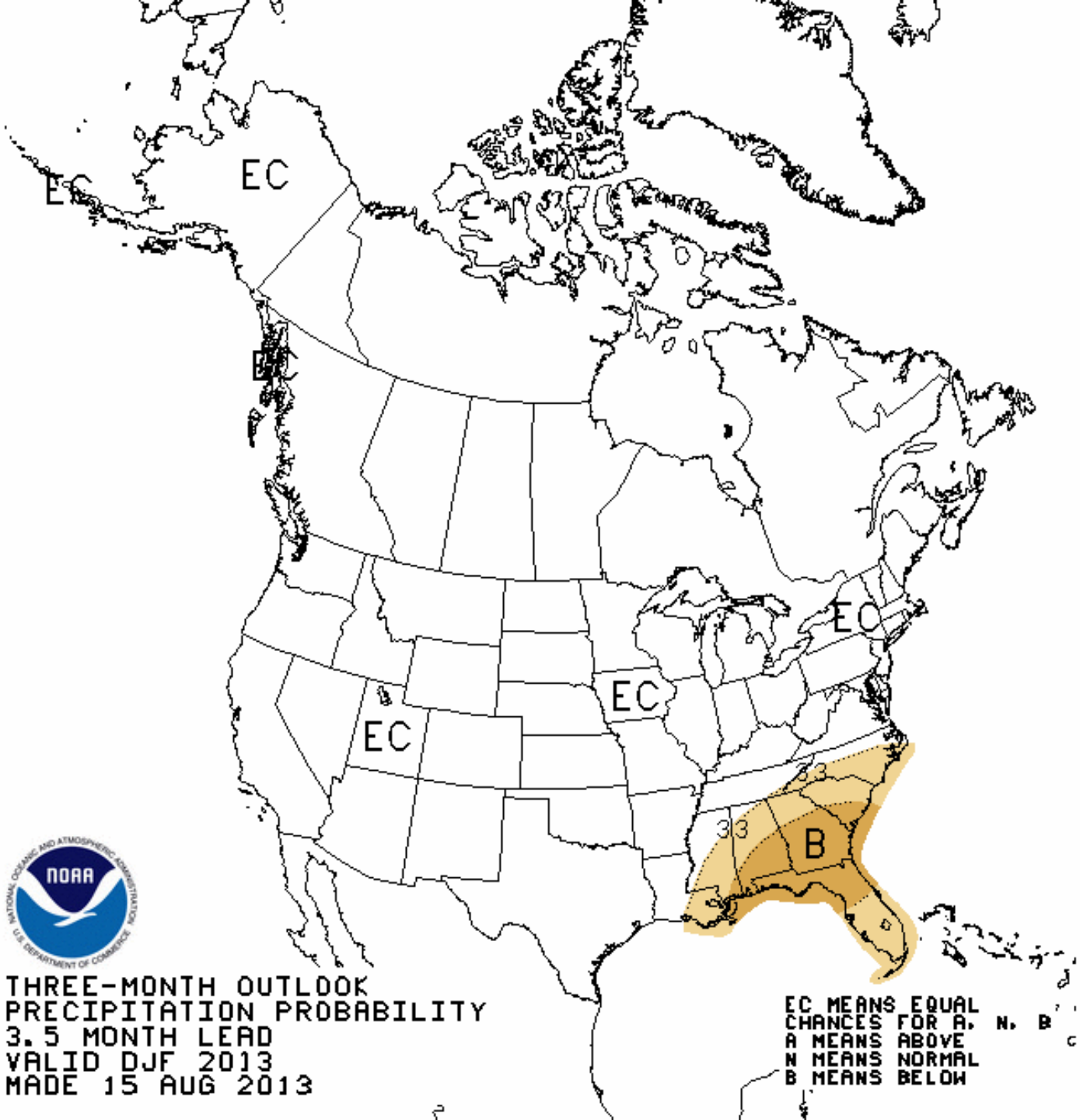
USDA National Drought Mitigation Center



IRI Climate and Society

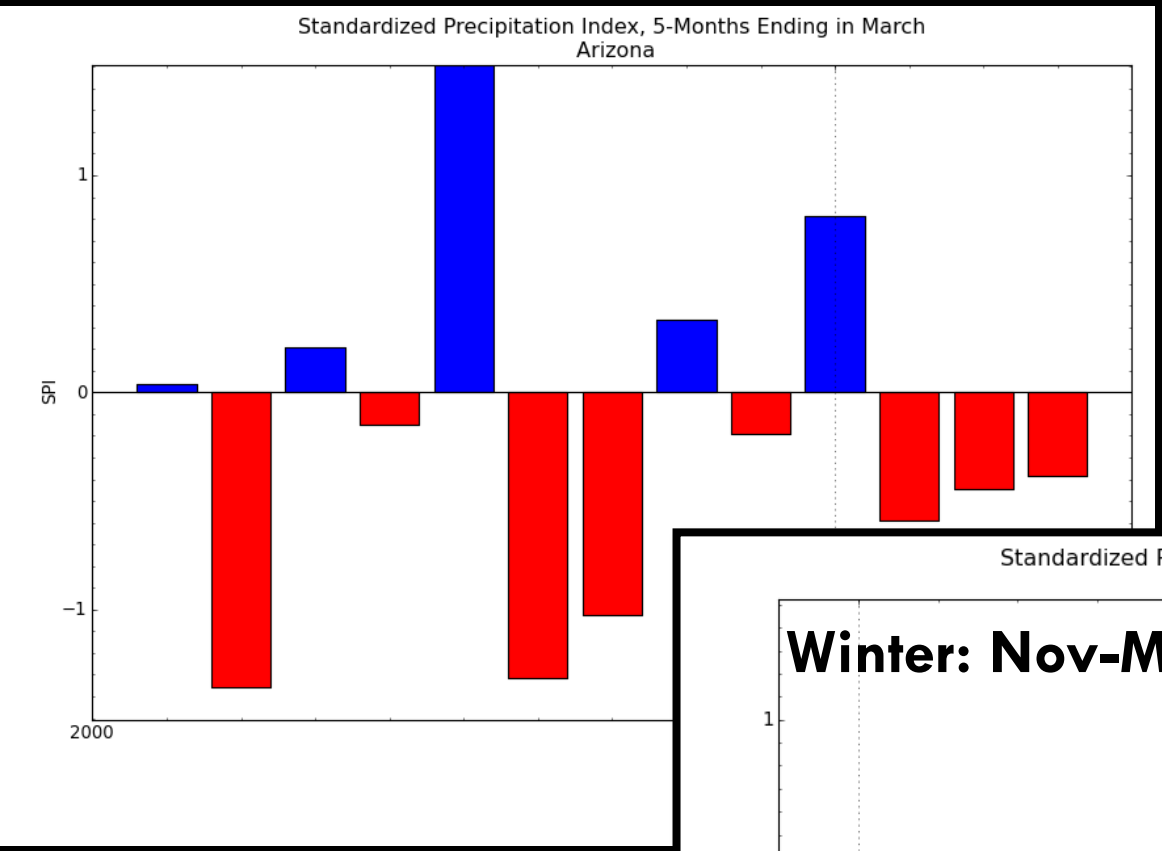

Upper Colorado
October-March Precip (in)
October-March SOI
La Nina
Nuetral
El Nino
12
10
8
6
4
2
-3
-2.5
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
2.5
3


AZ CD4
Nov-March Precip (in)
Nov-March SOI
La Nina
Nuetral
El Nino
9.5 in: 1950-2010 avg
30
25
20
15
10
5
0
-3
-2.5
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
2.5
3

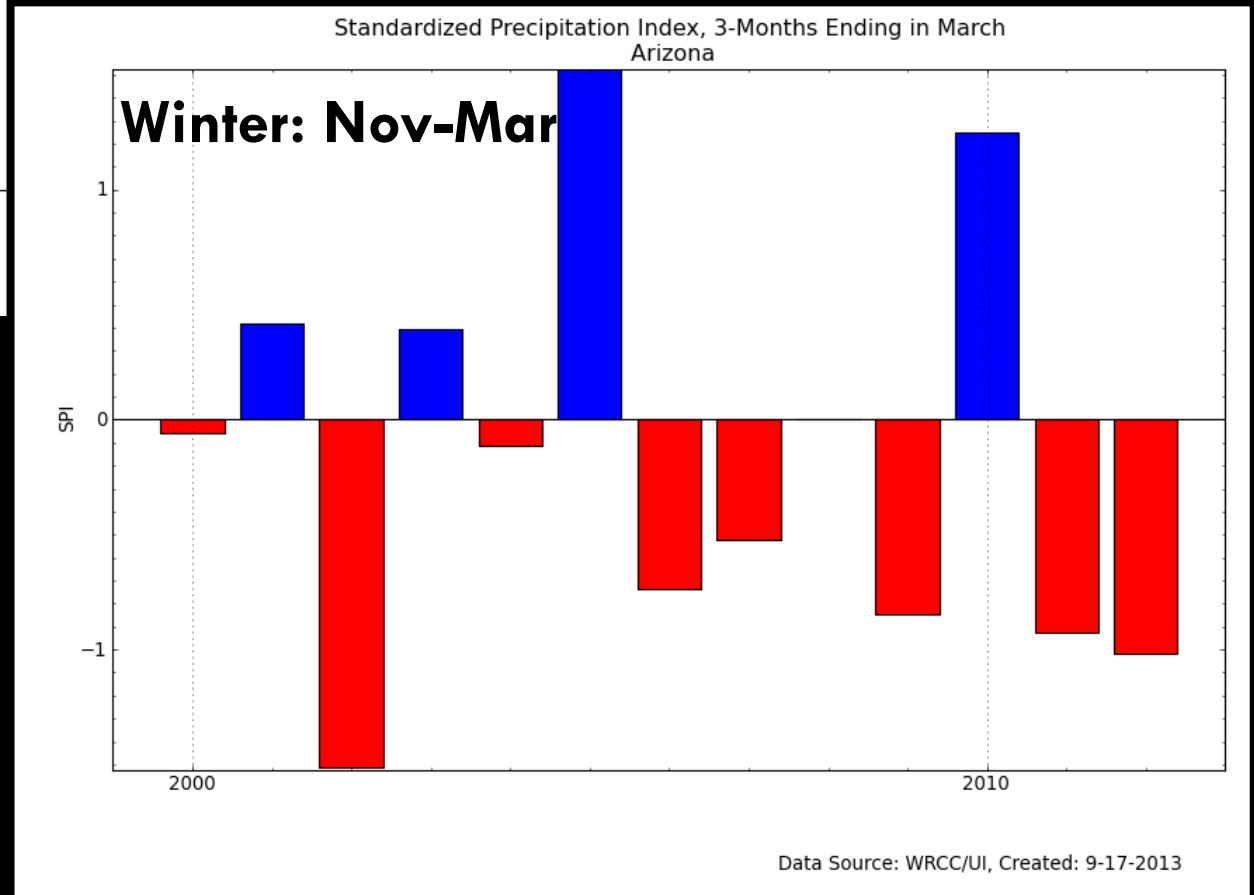

EC
EC
EC
EC
EC
EC
33
33
B
THREE-MONTH OUTLOOK
PRECIPITATION PROBABILITY
3.5 MONTH LEAD
VALID DJF 2013
MADE 15 AUG 2013
EC MEANS EQUAL
CHANCES FOR A, N, B
A MEANS ABOVE
N MEANS NORMAL
B MEANS BELOW

Thanks

zguido@email.arizona.edu


Standardized Precipitation Index, 5-Months Ending in March
Arizona
SPI
1
0
−1
2000

Monsoon: JAS


Standardized Precipitation Index, 3-Months Ending in March
Arizona
Winter: Nov-Mar
SPI
1
0
−1
2000
2010
Data Source: WRCC/UI, Created: 9-17-2013